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NANTICOKE WATER MOVEMENTS

1967-1978

March, 1980

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Ministry of the Environment
Ontario

The Honourable
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Minister

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NANTICOKE WATER MOVEMENTS
1967-1978

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March, 1980

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NANTICOKE WATER MOVEMENTS 1967-78

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FOREWORD

The Nanticoke Environmental Committee (NEC) was established in 1968 to study the biological, chemical and physical processes of the coastal area of Nanticoke - Long Point Bay region of Lake Erie, the interactions and any changes in the complex processes which may be attributed to the industrial devlopment of the area. NEC consists of the following member agencies: Ontario Ministry of the Environment (MOE), Ontario Ministry of Natural Resources (MNR), Ontario Hydro (OH), Stelco and Texaco. The Committee commenced the multi-disciplinary study of the Region in 1968 and continued each year, thereafter. The multi-disciplinary study consists of water movements (MOE and OH), water chemistry (MOE), water temperatures (OH), attached algae (OH), bottom fauna (MOE), phytoplankton (MOE), zooplankton (MNR) and fish (MNR).

This report summarizes the water movements in the region, conducted and reported by Ontario Ministry of the Environment and Ontario Hydro from 1967 to 1978.

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NANTICOKE WATER MOVEMENTS 1967-1978

SUMMARY

Current measurements by drogues and continuous recording current meters were carried out by Ontario Hydro and Ontario Ministry of the Environment in the Nanticoke-Long Point Bay area from 1967 to 1978.

Current measurements by drogues during 1967 and 1968 indicated that the drogues generally followed the wind direction; current speeds varied from 1-18 $cm.s^{-1}$.

Water movements measured by current meters between 1968 and 1978, showed a predominance to the east and west directions or roughly parallel to the shoreline.

(a) For all locations, the net movement was towards the east for 61% and towards the west for 16% of the time, while the net wind was towards the east for 86% of the time. Average current speeds varied from 0.5 to 13.8 $cm.s^{-1}$ with the maximum recorded speed being 75 $cm.s^{-1}$.

(b) Overall current frequency distribution in the vicinity and off-shore of Nanticoke Generating Station indicated a water movement to the east for 43% of the time and to the west for 17% of the time. Similarly, overall wind frequency distribution for the corresponding period was 46% to the east and 17% to the west. Other areas like Peacock Point and Stelco dock showed local influences.

Spectral analysis of currents indicated the dominance of lakewide, diurnal and tidal motions during 1968-70. From 1973 to 1977, currents were generally due to the local motions although some lakewide motions were also observed. Significant cross-correlations of currents at different locations, currents and wind, and currents and water level were observed. The study area was considered homogeneous for currents and was dynamically connected.

This study should provide the basis of comparison with any future changes or trend in current climatology due to the industrial growth of the area.

NANTICOKE WATER MOVEMENTS 1967-1978

INTRODUCTION

The Provincial Government and the industries have taken steps to ensure that the industrial development at Nanticoke does not adversely affect water quality and movements in the coastal area of Lake Erie between Port Dover and Peacock Point. The major industrial units located at Nanticoke are Ontario Hydro, Steel Company of Canada (Stelco) and Texaco of Canada, supported by ancillary plants in the nearby Industrial Park. The industry uses the coastal waters of Lake Erie for water supply as well as for effluent discharges. The Nanticoke Environmental Committee (NEC) was established to study the biological, chemical and physical processes of the coastal areas of the Nanticoke-Long Point Bay region of Lake Erie, the interactions and any changes in the complex processes which may be attributed to the industrial development of the area. The pre-operational studies commenced during 1967 and continued every summer since then. Farooqui (1976, 1978), Kohli (1974, 1976, 1977, 1978, 1979a, 1979b) and NEC (1973, 1978) have previously reported on water movements in the Nanticoke region of Lake Erie.

This report discusses the combined results of Langrangian and Eulerian current measurements conducted by Ontario Hydro (OH) and Ontario Ministry of the Environment (MOE) from 1967 to 1978. The Langrangian method tracks the trajectories of water parcels which are plotted in space and time. Drogue trackings were used in this study. Ontario Hydro conducted the Langrangian current or drogue studies during 1967 and 1968 to determine the spatial characteristics of currents for the optimum design of Nanticoke Generating Stations' condensor cooling water system. The Eulerian method consists of mechanical or dynamical measurements of the flow past a geographically fixed point. From 1968 to 1978, OH and MOE conducted Eulerian studies by operating in-situ current meters at different locations. (See Figure 1.)

DATA

Langrangian Currents

Drogues were tracked by Ontario Hydro between June and November on 25 days in 1967, and 16 days in 1968. The area tracked ranged from Peacock Point to five km west of Nanticoke Creek and as far as four km from the shore.

Each drogue consisted of 0.6 m x 1.2 m panels affixed to a steel frame at an angle of 60^{o} to one another and suspended from a cylindrical styrofoam float by 3.2 mm diameter steel cable. A 1.8 m mast with a brightly coloured pennant was mounted through the float for tracking purposes.

Tracking of the drogues was accomplished by triangulation using two surveyor transits located at known positions on the shore. To facilitate the triangulation, several stations were established along the shore from Peacock Point to five kilometers west of Nanticoke Creek. Generally three or four drogues were released at a time, either at mid-depth, various distances from shore, or at various depths in one location, and were tracked for several hours (see Figures 2 to 8).

Eulerian Currents

Electronic submersible, self-recording current instruments (Geodyne, Hydro Products and Plessey) were operated in the coastal region of Lake Erie, offshore of Nanticoke, at different locations and periods (see Figure 1 and Table 1) from 1968 to 1978, with the exception of 1971-72. The instruments were calibrated prior to installation; a post mooring check was made to ascertain whether the instruments had functioned properly while moored.

Data from MOE instruments were numerically smoothed (see Appendix). All data were then partitioned into monthly records for year to year comparisons. Each data set was subjected to statistical analysis to determine the spatial and temporal characteristics of water movements

by the two-dimensional (current speed and direction) frequency of occurrence tables (see Appendix). MOE data were also subjected to spectral analysis to identify the physical mechanisms responsible for the water movements in the coastal region.

Wind

Continuous wind records have been obtained since May 1967, using an Environment Canada anemometer installed and operated by Ontario Hydro (see Figure 1), approximately 10 m above the ground. It was originally located adjacent to the Jarvis Pump House, near the west end of the Nanticoke G.S. and later transferred to the coal dock near the lakeshore (see Figure 1).

Data obtained by Environment Canada at Simcoe were substituted for missing records. Two-dimensional frequency of occurrence of wind speed and direction were computed by months and are presented in Table 2.01 to 2.51 (see Appendix) for the current meter study period of 1968-78.

Water Level

Water levels were recorded in the Jarvis Pump House in 1967 and 1968 to monitor changes in the lake levels during drogue surveys. Water levels were also obtained from the Canadian Hydrographic Service recorder at Port Hope.

DISCUSSIONS

Langrangian Currents

The results of the drogue tracking in terms of date, test area, drogue depth, average speed and direction, wind speed and direction and change in water level are summarized in Table 2 for 1967 and Table 3 for 1968. The current patterns that were recorded during both 1967 and 1968 have been plotted for eight specific wind directions and are presented in Figures 2 to 8.

The drogue trajectories, for specific wind directions (see Figures 2 to 8), indicate that during those occasions when the surveys were carried out, current direction was alongshore about three quarters of the time with a slight predominance to the east. It is also evident that wind was a major factor affecting water movement in the area. About 80% of the time the drogue movement was in the same general direction as the wind. Drogue directions were, on occassion, skewed to the left or right of the wind by $\pm$ 45^{o}. Currents to the east were associated with winds to the east quadrant while currents to the west were in line with winds to the west quadrant. Currents normal to shore were comparatively weak and infrequent. A distinct clockwise rotation was observed in the outfall bay area which could be attributed to the bed contour and the geometry of the shore line. A more detailed analysis of the current pattern indicated by drogues is given by Ontario Hydro (1967 and 1968).

Average current speeds varied considerably from 2 to 18 cm.s^{-1}. For brief periods the maximum drogue speeds reached as high as 30 cm.s^{-1}. These maximum speeds would have been higher had the drogues been tracked under stronger wind conditions (drogues could not be tracked when wind speed exceeded 40 km.h^{-1}).

Eulerian Currents

The lake currents are generally generated by wind stress, seiches, lakewide and local oscillations, bottom topography and friction, thermal structure and inflow through major tributaries. The balance among the wind stress force, the Cariolos force, the pressure force and frictional forces must vary spatially in the lake, resulting in the variability of the velocity field. Boyce (1974) described physics of Great Lakes adequately.

The monthly current climatology is best described by the statistical summaries of water movements, from 1968 to 1978 (see Tables 4.1 to 4.9). A persistence factor indicates the degree of persistence of current in a particular direction. Persistence is zero if the net transport is zero or the current is equally divided in all

directions. Persistence equals 1.0 if the current is in any one direction for the entire period of record. Persistence factors varied from 0.01 to 0.99 indicating the variability of the currents. The resultant currents varied from 0.2 to 11.3 $cm.s^{-1}$, the arithmetic average speed ranged from 0.5 to 13.8 $cm.s^{-1}$ and the maximum speed for any record was from 8 to 75 $cm.s^{-1}$. The resultant currents and winds (vector averages) are shown in Figures 9 to 17, indicating the net water and wind movements towards the east.

Table 5 presents the net water movement directions for nearshore locations, offshore locations and all locations. For the nearshore locations, net currents were towards east for 55%, towards west for 16% and towards south for 25% of the time. For the offshore locations, net currents were towards east for 66%, towards west for 16%, towards north for 12% and towards south for 6% of the time. The above indicates that nearshore currents are affected by the local shoreline and travel offshore (to south) for 25% of the time and alongshore (east-west) for 71% of the time. At the offshore locations, net currents were alongshore for 82% of the time. Combining all nearshore and offshore locations together i.e. for all locations, net currents were alongshore for 77% of the time (see Figure 18) indicating the similarity of currents at nearshore and offshore locations in Nanticoke. It will be seen from Table 10 that the wind resultant was towards the east for 86% of the time, indicating a correlation of currents and winds.

Although the Nanticoke Long-Point Bay region has been proven dynamically homogenous (Kohli 1974, 1976 and 1978), local influences play a dominant role. The depth contours, the configuration of the shoreline and the proximity of manmade structures all contribute to the water movement pattern to a certain degree.

The frequencies of occurrence of water movement by quadrants, the mean, the maximum, and the net speeds for all study periods from 1968 to 1978 are presented in Tables 6.1 to 6.3 for five specific locations and are discussed here briefly.

(i) Area in the vicinity and offshore of Nanticoke Generating Station excluding the outfall area

The region has been extensively studied from 1968 to 1978 and the results have been summarized by years in Table 6.1.

Table 6.1 shows that the predominant water movement was to the east for 43% of the time as compared to the west 17% of the time. The movements to the north and south were relatively weak, 14% of the time, in each direction. The periods of negligible speeds were 13%.

(ii) Outfall of Nanticoke GS

This area was studied during 1973, 1974 and 1977 and the results as summarized in Table 6.2 which were similar to those observed at area (i). The only significant change was a relatively higher percentage frequency to the south that could be attributed to the jet effect of the Nanticoke C.C.W. discharge.

(iii) Peacock Point

Water movement off Peacock Point was recorded for a limited period in 1973 only and a summary of results is presented in Table 6.2. It may be noted that mean speeds were unusually low (1.3 $cm.s^{-1}$) and the periods of negligible speed (calm) were very high (63% of the time). It is not certain whether the water movement pattern observed in 1973 was typical of the location or just time related.

(iv) Stelco Dock

The Stelco dock (see Figure 1) construction commenced in April 1975 and was completed in October 1976. The dock extends 1190 m into the lake and comprises three sections: a 320 m nearshore bridge; a 420 m causeway; and a 450 m wharf including the offshore bridge. To facilitate construction, a temporary causeway was built at the site of the nearshore bridge in April 1975 (Chamberlain, 1978). This blocked the water movements, accumulated sediments and led to their resuspension. The temporary causeway was removed in October 1976 to

allow the free movement of water, fish and sediments along the shoreline. Chamberlain (1978) showed that while the turbidity increased near the dock during construction, it decreased at the completion of construction indicating no permanent effect of the dock on turbidity.

Current measurements under the bridges and in the vicinity of the Stelco dock were made in 1975, 1976 and 1978 and the results are summarized in Table 6.3. It may be noted that water movement pattern varied considerably from year to year. The construction of the dock was completed in October 1976. The average movement was along east-west direction and was relatively slower due to the presence of the physical barrier near the study area (Kohli 1978, 1979b). The 1976 study exhibited the current field convergence (Kohli, 1978) on both sides of the dock and this may be attributed to the presence of dock relative to the study locations (see Figure 15).

(v) West of Centre Creek

Current measurements were also carried out west of the Centre Creek and Stelco Site during 1969 and 1975. The results are presented in Table 6.3. It may be noted that the current direction was along east-west quadrants parallel to the shoreline in both years. In 1969, the predominant movement was to the east (37% of the time) while in 1975, it was equally divided between the east and the west quadrants.

Figures 19 and 20 show the comparison of water movements over the years 1968-78, by annual means of the resultants and average currents with $\pm$ one standard deviation. The magnitudes of net currents appear similar except during 1970 and 1973 when the currents were generally slower. The reasons for slow water movements during February and March 1970 may be attributed to ice cover, and July to September 1973, are not known. Generally the currents are of similar magnitude and direction from year to year. Another comparison of water movement results for MOE data only is presented in Table 7, indicating that the currents for half the

records travel in a direction parallel to the resultant direction for 30 to 50% of the time. In three-tenths of the records, movements were parallel to the resultant direction in excess of 50% of the time. In one-fifth of the records, movements were parallel to the resultant direction for less than 30% of the time. Table 7, lists the distance travelled along the resultant direction in 10 hours (arbitrarily chosen) as a measure of comparison. The distances were computed for the quantitative comparison of water movements. The average distance travelled along the resultant direction in 10 hours during 1975 was the highest at 3.5 km with a standard deviation of 1.5 km (average/standard deviation ratio = 2:3). In other years, the average distance travelled along the resultant direction varied from 0.8 to 2.6 km in 10 hours with average/standard deviation ratios ranging between 1.7 and 2.0. The reason for larger distance travelled during 1975 may be partially explained by the high persistence factors. During 1975, for 73% of records, persistence factors were greater than 0.30, while they were greater than 0.50 for 45% of the records.

Autospectra

Autospectra for currents along North-South and East-West directions were computed for MOE data to understand the physical process responsible for the currents. A comparison of results is presented in Table 8.1 (Offshore Locations 1968-75) and 8.2 (Nearshore Locations 1973-77). No significant periodicities were observed during 1978, probably due to the location of current meters under the two bridges at the Stelco dock. During 1968-70, significant periodicities indicated the predominance of lakewide, semi-diurnal (tidal motions) and diurnal effects on the currents. During 1968, the significant periodicities ranged from 5 to 24 h along north-south direction. For 1969 and 1970, the lowest significant periodicity observed was 8 h; 60 h peaks were observed during 1970 (under ice conditions). From 1973 to 1975, the highest observed periodicity was 15 h but most of the peaks were concentrated between 2 and 5 h. During 1973 to 1975, the periodicities at nearshore and offshore locations (see Tables 8.1 and 8.2) were similar indicating no differences due to the proximity of the shoreline.

Rockwell (1966) computed the first five modes of longitudinal free oscillations of Lake Erie as 14.1, 8.9, 5.7, 4.1, and 3.7 h. Merian period of Lake Erie was theoretically computed as 16.8 h and the fundamental period of Long Point Bay was estimated as 2.5 h (Rockwell, 1966). Therefore, during 1968, the lowest two modes of longitudinal free oscillations of Lake Erie and the fundamental period of Long Point Bay were not observed. In 1969, the lowest four modes and the fundamental period of Long Point Bay were absent. Periodicities of less than the fundamental period of Long Point Bay are generally associated with the local shoreline geometry. Such effects were not observed during 1968 and 1969. From 1973 to 1977, the merian period was observed once during 1976 along East-West direction at a nearshore location. The first mode of free oscillations (14.1 h) was not observed after 1969. The second mode (8.9 h) was observed from 1973 to 1975, but it was absent during 1976-77. The last three modes of oscillations (5.7, 4.1 and 3.7 h) were observed in all years from 1973 to 1977. Periodicities of 2 to 3 h are associated with the local geometry and these have been observed from 1973 to 1977. However, the local shoreline effects became dominant during 1975-76.

Cross-Correlations

Table 9 presents the summary of coherences or cross-correlations during 1968 and 1969, between currents and wind, currents and water levels and currents at two locations. Significant coherences were observed between the east-west currents at two locations, currents and wind as well as currents and water levels. Coherences along the north-south components were not as frequent as along the east-west (alongshore) direction. The study area (see Figure 1) is considered homogenous since (i) the current magnitudes at all locations and for all months are of the same order, (ii) the current direction is predominantly parallel to the shore at all locations, and (iii) coherences between the currents at different locations have significant periods (see Table 9). Therefore, all instrument locations may be considered homogenous and may be dynamically connected.

WIND

Tables 10 and 11 present the statistical summary of wind at Nanticoke G.S., Lake Erie during the period of current meter operations from 1968 to 1978. The resultant wind vectors have been plotted long with the resultant currents to facilitate easy comparison (see Figures 9 to 17). Table 10 and Figures 9 to 17 indicate the predominance of wind towards east (North-East to South-East). It can be shown from Table 10 that the resultant wind direction was towards the east (North-East to South-East) for 86% of the records, towards the north (North-West to North East) for 10% of the records and 2% of the records each towards the west and south. The resultant currents were towards east (North-East to South-East) for 61% of the records (see Table 5), towards the north for 8% of the records, 16% towards the west and 15% towards the south. This shows a good correlation of wind and current directions.

In order to delineate the long term pattern of water movements in the Nanticoke area, the frequency distribution of wind as recorded at Nanticoke G.S. from 1967 to 1979 is presented as a rose histogram in Figure 21. It is reasonable to conclude from Figure 21 that wind and current towards east may be expected for a large percentage of the time. Onshore and offshoe currents would be relatively weak and are likely to be found primarily during wind reversal situations.

CONCLUSIONS

During 1967 and 1968, the average Langrangian current speed, as measured by drogue trackings, varied from 2 to 18 $cm.s^{-1}$, while the maximum speed recorded was 30 $cm.s^{-1}$. Although greater current speeds existed under higher wind conditions, these could not be measured by drogues due to difficulties in drogue trackings under high winds (greater than 40 km h^{-1}). For 80% of the time, the drogues moved in the general direction of the wind. Drogue studies indicated that wind was a major factor affecting water movements.

The Eulerian current measurements from 1968 to 1978 resulted in the monthly average current speeds from 0.5 to 13.8 $cm.s^{-1}$; comparable to the average drogue speed range of 2 to 18 $cm.s^{-1}$. The current meters measured a maximum speed of 75 $cm.s^{-1}$ which is beyond the range of drogue measurements. The persistence factors varied from 0.01 to 0.99 indicating the variability of the currents.

The net water movement was predominantly (77%) to the east-west direction or parallel to the shoreline. For 61% of the time, the net currents moved towards the east while the net wind was in the same direction for 86% of the time; indicating a good correlation between the wind and current.

Autospectra of currents showed that during 1968 to 1970, currents were generated due to lakewide, diurnal and tidal motions. From 1973 to 1977, currents were generally due to local motions although some lakewide motions were also observed. Significant cross-correlations of currents at two locations, currents and wind, currents and water level were observed. The study area was considered homogeneous for currents and was dynamically connected.

The net wind at Nanticoke G.S. was towards east for 86% of the time and onshore for 10% of the time. A strong correlation between the wind and current direction was observed as shown by the coherence analysis.

No significant changes in the current climatology were observed during 1967 to 1978 except for 1970 when the currents were generally slower due to the ice cover and 1973 when the currents were slower due to unknown reasons. The 1976 study exhibited the current field convergence on both sides of the Stelco dock and this phenomenon may be attributed to the presence of the dock relative to the study locations.

RECOMMENDATIONS

It was decided by NEC Technical Committee to continue all the studies until 1984 at which time any proposed future studies will be re-assessed.

As Stelco has just started operations and will probably take a few years to reach their designed production capacity, it is recommended to continue the water movement study offshore of Stelco property and to monitor the effects of their present discharge into Centre Creek and the subsequent discharge by an extended submerged outfall in Lake Erie.

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TABLE 1: Current Instrument Operations Offshore of Nanticoke, Lake Erie 1968-1978

Location Code	Instrument Type	Instrument No.	Instrument from Bottom (m)	Total Water Depth (m)	Period of Operation From	To
0201	P*	162	2.7	9.4	1 Oct 68	6 Nov 68
	P	159	2.7	9.4	7 May 69	31 Jul 69
	P	159	2.7	9.4	22 Dec 69	27 Jan 70
	P	159	2.7	9.4	19 Feb 70	11 Mar 70
0202	P	164	4.6	10.0	1 Aug 68	27 Nov 68
	P	144	4.6	10.0	10 Jun 69	31 Jul 69
0203	P	272	5.5	11.9	4 Sep 68	27 Nov 68
0204	P	272	4.6	9.8	8 May 69	31 Jul 69
0205	P	207	2.4	6.1	19 Jul 73	11 Aug 73
	G**		2.4	6.1	22 Jul 77	31 Aug 77
0206	G	453	3.7	9.1	20 Jul 73	18 Sep 73
0207	P	206	3.0	6.1	8 Aug 74	30 Sep 74
	P	144	3.0	6.1	12 Oct 74	27 Nov 74
OH11	H+		3.0	9.0	19 Jun 74	5 Dec 74
0208	P	162	3.0	6.7	20 Apr 74	27 Jun 74
	P	144	3.0	6.7	17 Jul 74	27 Jul 74
	P	207	3.0	6.7	11 Oct 74	24 Oct 74
0209	G	027	3.0	7.0	9 May 75	22 Jun 75
	G	039	3.0	7.0	20 Sep 75	10 Nov 75
0210	G	025	2.7	5.8	9 May 75	27 Jul 75
	G	038	2.7	5.8	20 Sep 75	1 Nov 75
0211	P	162	3.0	7.9	9 May 75	30 Jun 75
	P	164	3.0	7.9	20 Sep 75	18 Nov 75
0212	P	164	4.0	9.1	9 May 75	7 Jul 75
	P	162	4.0	9.1	20 Sep 75	19 Nov 75
OH22	H		3.0	9.0	8 Apr 76	20 Dec 76
0213	G	279	2.5	7.0	21 May 76	19 Oct 76
0214	G	278	2.5	7.0	21 May 76	31 Aug 76
OH22	H		3.0	9.0	8 Apr 77	19 Dec 77
0217	P	189	4.3	8.5	20 Sep 77	14 Nov 77
OH22	H		3.0	9.0	8 Jun 78	9 Sep 78
0218	P	239	8.8	11.5	25 Jul 78	18 Aug 78
0219	P	189	2.0	4.0	25 Jul 78	18 Aug 78

* Plessey (operated by MOE)
** Geodyne (operated by MOE)
+ Hydro Products (operated by OH)

TABLE 2: Summary of Drogue Surveys, Offshore of Nanticoke G.S., Lake Erie, 1967

Date	Test Area	Depth of Drogue from surface (m)	Average Drogue Speed ($cm.s^{-1}$)	Average Drogue Direction 'TO'	Average Wind Speed ($km.h^{-1}$)	Average Wind Direction 'TO'	Change in Water Level (m)
Jun 15	Nanticoke Creek	2	4.0	E	13-24	N	-0.09
16	Nanticoke Creek	2	2.7	NE-E	18-29	N	-0.03
		4	2.7	SW			
21	Nanticoke Creek	2	1.2	S-SW-SE	6-26	N-S	+0.12
		4	1.2	WNW			
		5	3.7	WNW			
22	Intake*	2	7.6	SE-NE	11-31	S-N	-0.30
		4	7.9	E-ENE			
		5	7.0	ENE-NE			
23	Intake	2	0.9	NW	8-24	S-N	+0.12
		4	1.2	NNE-W			
		5	5.5	NE			
27	Intake	2	5.5	WSW	3-8	N	-0.09
		4	2.1	WNW			
		5	2.1	WSW			
28	Nanticoke Creek	2	8.5	W-SW	21-26	SW	+0.07
		4	8.8	SW			
		5	11.3	SW			
Jul 4	Nanticoke Creek	2	12.2	WSW	6-16	SW	+0.03
		4	7.0	WSW			
		5	8.8	S-W			
5	Intake	2	2.7	E	6-14	SE	+0.07
		5	4.0	E			
		6	3.7	ESE			
6	Intake	2	2.7	SSW	5-16	N-NW	-0.06
		5	4.9	E-SW			
		7	4.9	SE-SW			
12	Outfall+ Bay	1	Grounded		10-19	N	-3.0
		3	3.0	NNE-NE			
		5	4.9	ENE			
13	Outfall Bay	2	2.7	N-E-NE	18-27	NW	-0.03
		3	1.8	N-S-E			
		6	1.8	NE-NW			
		8	4.6	WSW-WNW			

* Nanticoke G.S. Cooling Water Intake
\+ Nanticoke G.S. Cooling Water Outfall

TABLE 2: (continued)

Date	Test Area	Depth of Drogue from surface (m)	Average Drogue Speed ($cm.s^{-1}$)	Average Drogue Direction 'TO'	Average Wind Speed ($km.h^{-1}$)	Average Wind Direction 'TO'	Change in Water Level (m)
Aug 22	Outfall Bay	2	0.9	SW			
		4	1.8	ENE	10-18	SW	+.0.06
		5	2.1	NE-E-S			
23	Outfall Bay	2	8.5	W			
		4	2.7	WSW-WNW	16-19	SE	-0.09
		5	1.2	NW			
24	Outfall Bay	2	9.4	WNW			
		3	4.0	W	13-23	W	-0.03
		4	5.8	NW			
29	Outfall Bay	3	7.6	NE-ENE	18-32	NE	+0.02
		3	12.2	NE-NNW			
30	Intake	2	2.1	SW-E-SE			
		4	2.1	SW	8-21	SE	-0.02
		5	3.7	ENE-ESE			
31	Intake	2	7.0	SW-W			
		4	8.5	SW	11-29	SW	+0.11
		5	14.3	SW-SSW			
Sep 26	Outfall Bay	2	Grounded				
		3	6.7	NE	24-40	NE	-0.18
		4	10.4	NNE-E-SE			
27	Intake	1	3.7	SSE-SSW	3-27	S	+0.04
		2	3.0	E-S			
28	Intake	1	6.4	SE	19-24	SW	-0.05
Oct 24	Outfall Bay	1	2.7	NE-NNE			
		3	2.1	NNE	5-21	N	-0.03
		3	1.8	W-N			
		1	13.7	NE-E			
		3	14.6	ENE-ESE	40-45	NE	-0.02
		3	12.2	E-SE			
26	Outfall Bay	1	9.8	NE-E			
		3	9.8	E-ESE	23-31	E	+0.05
		3	10.4	E-ESE			

TABLE 3: Summary of Drogue Surveys, Offshore of Nanticoke G.S., Lake Erie, 1968

Date	Test Area	Depth of Drogue from surface (m)	Average Drogue Speed ($cm.s^{-1}$)	Average Drogue Direction 'TO'	Average Wind Speed ($km.h^{-1}$)	Average Wind Direction 'TO'	Change in Water Level (m)
Jun 4	Intake*	2	6.1	NE	14-18	NE	-0.02
		4	2.4				
		5	2.7				
5	Outfall+ Bay	3	2.7	N-NE	8-31	NE	-0.03
		4	2.1	NE			
		4	5.2	N-NE			
6	Outfall Bay	1	5.8	NE	8-26	NE	-0.03
		2	4.0				
		3	3.4				
7	Outfall Bay	2	1.2	NNE	5-8	NE	-0.02
		3	1.5				
		3	1.8				
Jul 9	Outfall Bay	2	6.4	ENE	21-29	E	-0.06
		4	4.9				
		4	3.0				
10	Outfall Bay	2	4.3	W	8-16	S (AM)	
		2	3.4	SSW			+0.19
		2	4.3	SW-WNW		SW (PM)	
		2	7.0	W			
		2	2.4	SSW			
11	Outfall Bay	2	2.7	NW		SW (AM)	
		3	2.7	SW-W-N	6-19		+0.09
		3	3.7	W		W (PM)	
		3	5.2	W			
12	Intake	2	2.4			SE (AM)	
		2	6.7				-0.04
		3	4.3	NW	8-11	NW (PM)	
		3	5.5				
		3	4.3				
Aug 13	Nanticoke Creek	2	3.4				
		2	11.6	NE	19-35	NE	-0.06
		2	4.6				
		2	4.9				
		2	10.1				

* Nanticoke G.S. Colling Water Intake
\+ Nanticoke G.S. Cooling Water Outfall

TABLE 3: (continued)

Date	Test Area	Depth of Drogue from surface (m)	Average Drogue Speed ($cm.s^{-1}$)	Average Drogue Direction 'TO'	Average Wind Speed ($km.h^{-1}$)	Average Wind Direction 'TO'	Change in Water Level (m)
14	Intake	5	6.7	E			
		5	6.7				
		6	7.9	and	19-26	NE	-0.08
		6	8.5				
		6	7.3	NE			
		6	8.8				
Aug 15	Nanticoke	5	2.4	W			
	Creek	5	5.2	NW	13-19	W	-0.11
		5	5.2	NW-W			
		5	6.7	W			
16	Intake	5	6.1	W	8-24	W	
		5	2.1			W	+0.04
	Nanticoke	5	6.4	W-N		NE	
	Creek	5	2.1			N	
Sep 6	Intake	6	2.4	WSW	14-21	NW	+0.01
		6	1.8				
		6	3.4				
		6	3.7				
11	Intake	5	7.3	ENE	19-24	NE	+0.00
		5	6.4				
12	Stelco	5	4.6	E	11-23	SE	-0.07
		5	12.1				
		5	17.7				
		5	20.4				
		6	13.1				
		6	13.7				
Nov 5	Stelco	5	4.3	W	14	SW	+0.05
		5	8.2				
		5	9.1				
		5	9.4				

TABLE 4.1: Statistical Summary of Current Meter Operations, Offshore of Nanticoke, Lake Erie 1968

	LOCATION								
	0201		0202				0203		
	PERIOD								
	OCT	NOV	AUG	SEP	OCT	NOV	SEP	OCT	NOV
Resultant direction (0^o as North)	92	118	82	97	91	93	97	88	93
Resultant speed (cm. s^{-1})	1.50	0.60	2.30	2.10	5.00	10.90	1.20	3.60	4.80
Average speed (cm. s^{-1})	5.20	3.10	4.20	4.70	6.60	10.90	1.70	6.80	9.40
Maximum speed (cm. s^{-1})	25	12	19	19	25	25	21	43	40
Persistence factor	0.29	0.20	0.54	0.44	0.75	0.99	0.70	0.54	0.51
Percentage of negligible* speed (% of recording period)	18	28	15	10	10	1	54	31	21
Percentage of time going in direction of resultant	44	14	40	45	59	85	52	52	59
Total number of readings	4464	851	4322	4271	4320	1119	3735	4393	3610
Interval of readings (min)	10	10	10	10	10	10	10	10	10

* $<$ 0.30 cm. s^{-1}

TABLE 4.2: Statistical Summary of Current Meter Operations, Offshore of Nanticoke, Lake Erie, 1969

	LOCATION							
	0201			0202		0204		
	PERIOD							
	MAY	JUN	JUL	JUN	JUL	MAY	JUN	JUL
Resultant direction (0^o as North)	76	254	247	75	196	98	96	198
Resultant speed (cm. s^{-1})	2.40	0.20	1.20	2.30	3.10	4.20	3.30	0.50
Average speed (cm. s^{-1})	3.70	2.50	3.36	4.30	4.20	5.80	4.50	3.60
Maximum speed (cm. s^{-1})	32	22	46	41	25	35	48	31
Persistence factor	0.66	0.07	0.36	0.53	0.74	0.72	0.74	0.15
Percentage of negligible* speed (% of recording period)	36	38	29	24	25	31	28	35
Percentage of time going in direction of resultant	27	20	27	23	42	50	38	12
Total number of readings	3456	4309	4464	2969	4256	3450	4265	4458
Interval of readings (min)	10	10	10	10	10	10	10	10

* $<$ 0.30 cm. s^{-1}

TABLE 4.3: Statistical Summary of Current Meter Operations, Offshore of Nanticoke, Lake Erie, 1970

	LOCATION 0201	
	PERIOD	
	FEB	MAR
Resultant direction (0^o as North)	75	249
Resultant speed (cm. s^{-1})	2.20	0.90
Average speed (cm. s^{-1})	3.80	1.50
Maximum speed (cm. s^{-1})	28	16
Persistence factor	0.56	0.61
Percentage of negligible* speed (% of recording period)	40	74
Percentage of time going in direction of resultant	33	33
Total number of readings	3533	2758
Interval of readings (min)	10	10

* $<$ 0.30 cm. s^{-1}

TABLE 4.4: Statistical Summary of Current Meter Operations, Offshore of Nanticoke, Lake Erie, 1973

	LOCATION			
	0205	0206		
	PERIOD			
	JUL	JUL	AUG	SEP
Resultant direction (0^o as North)	196	305	257	287
Resultant speed (cm. s^{-1})	1.32	0.95	0.25	0.49
Average speed (cm. s^{-1})	3.48	2.37	0.52	1.90
Maximum speed (cm. s^{-1})	18	23	14	20
Persistence factor	0.38	0.40	0.47	0.26
Percentage of negligible* speed (% of recording period)	19	57	74	48
Percentage of time going in direction of resultant	20	12	26	18
Total number of readings	1626	1728	4464	2452
Interval of readings (min)	20	10	10	10

* $\leq$ 0.30 cm. s^{-1}

TABLE 4.5: Statistical Summary of Current Meter Operations, Offshore of Nanticoke, Lake Erie, 1974

	LOCATION									
	0207					0208				
	PERIOD									
	AUG	SEP	OCT.A	OCT.B	NOV	APR	MAY	JUN	JUL	OCT
Resultant direction (0^o as North)	215	115	65	75	75	127	120	125	107	121
Resultant speed (cm. s^{-1})	0.92	0.67	3.03	1.64	1.33	3.23	1.75	2.00	3.39	5.81
Average speed (cm. s^{-1})	2.53	2.29	3.85	2.91	2.69	3.62	4.66	3.51	8.37	7.01
Maximum speed (cm. s^{-1})	15	13	34	16	31	15	18	26	38	23
Persistence factor	0.36	0.29	0.79	0.56	0.49	0.89	0.38	0.57	0.40	0.83
Percentage of negligible* speed (% of recording period)	18	15	6	10	10	15	4	30	3	2
Percentage of time going in direction of resultant	27	17	47	27	29	50	39	42	16	49
Total number of readings	3456	4320	604	2870	3834	720	2232	1917	1392	1872
Interval of readings (min)	10	10	10	10	10	20	20	20	10	10

* $\leq$ 0.30 cm. s^{-1}

TABLE 4.5: (continued)

	LOCATION #OH11							
	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JUN-DEC
Resultant direction (0^o as North)	327	23	82	59	41	53	109	50
Resultant speed (cm. s^{-1})	1.06	2.26	2.02	4.24	5.81	5.05	3.89	3.44
Average speed (cm. s^{-1})	4.55	5.24	5.97	7.54	7.14	7.36	6.73	6.50
Maximum speed (cm. s^{-1})	16	19	19	23	21	27	15	27
Persistence factor	0.23	0.43	0.34	0.56	0.81	0.69	0.58	0.53
Percentage of negligible* speed (% of recording period)	1	10	4	2	0	2	0	3
Percentage of time going in direction of resultant	10	41	22	55	86	52	28	64
Interval of readings (min)	30	30	30	30	30	30	30	30

* < 1.0 cm. s^{-1}

TABLE 4.6: Statistical Summary of Current Meter Operations, Offshore of Nanticoke, Lake Erie, 1975

	LOCATION										
	0209					0210					
	PERIOD										
	MAY	JUN	SEP	OCT	NOV	MAY	JUN	JUL	SEP	OCT	NOV
Resultant direction (0^o as North)	24	337	278	280	143	270	293	104	278	281	270
Resultant speed (cm. s^{-1})	3.32	0.18	3.11	1.34	3.85	2.10	0.79	1.90	4.06	4.30	11.25
Average speed (cm. s^{-1})	12.01	12.54	11.24	10.26	5.15	5.89	6.93	1.99	11.76	11.42	13.83
Maximum speed (cm. s^{-1})	27	19	29	37	19	19	25	15	38	38	57
Persistence factor	0.28	0.01	0.28	0.13	0.75	0.36	0.11	0.96	0.35	0.38	0.81
Percentage of negligible* speed (% of recording period)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percentage of time going in direction of resultant	17	8	44	31	46	40	15	48	58	50	71
Total number of readings	3311	3174	1584	4464	1439	3312	4320	3898	1584	4464	2692
Interval of readings (min)	10	10	10	10	10	20	20	20	10	10	10

* ≤ 0.30 cm. s^{-1}

TABLE 4.6: (Continued)

	LOCATION										
	0211					0212					
	PERIOD										
	MAY	JUN	SEP	OCT	NOV	MAY	JUN	JUL	SEP	OCT	NOV
Resultant direction (0^o as North)	49	44	91	80	94	84	87	96	86	110	110
Resultant speed (cm. s^{-1})	1.34	4.28	2.71	2.20	4.06	2.80	2.59	4.38	3.02	1.82	7.09
Average speed (cm. s^{-1})	5.50	8.76	3.99	3.69	4.81	4.16	3.90	5.06	6.68	5.68	8.28
Maximum speed (cm. s^{-1})	34	32	21	16	24	16	24	15	22	32	43
Persistence factor	0.24	0.49	0.68	0.60	0.84	0.67	0.65	0.87	0.45	0.32	0.86
Percentage of negligible* speed (% of recording period)	11	3	7	11	6	9	9	6	3	5	5
Percentage of time going in direction of resultant	24	36	41	29	44	37	30	52	49	25	25
Total number of readings	3311	4200	1584	4464	2573	3311	4320	1103	1584	4464	2619
Interval of readings (min)	10	10	10	10	10	10	10	10	10	10	10

* $<$ 0.30 cm. s^{-1}

TABLE 4.7: Statistical Summary of Current Meter Operations, Offshore of Nanticoke, Lake Erie, 1976

	LOCATION									
	0213						0214			
	PERIOD									
	MAY	JUN	JUL	AUG	SEP	OCT	MAY	JUN	JUL	AUG
Resultant direction (0^o as North)	81	319	103	132	166	220	165	223	263	249
Resultant speed (cm. s^{-1})	1.69	1.63	0.79	0.70	0.99	1.34	0.77	0.38	1.15	1.25
Average speed (cm. s^{-1})	2.45	3.22	3.49	2.82	4.04	3.78	1.13	1.64	2.02	1.95
Maximum speed (cm. s^{-1})	8	13	13	10	18	13	6	11	16	15
Persistence factor	0.69	0.50	0.23	0.25	0.24	0.35	0.68	0.23	0.57	0.64
Percentage of negligible* speed (% of recording period)	14	16	6	15	6	6	34	29	20	28
Percentage of time going in direction of resultant	40	35	18	18	18	20	45	8	34	24
Total number of readings	792	2160	2232	2232	2160	1341	792	2160	2232	2232
Interval of readings (min)	20	20	20	20	20	20	20	20	20	20

* < 0.30 cm. s^{-1}

TABLE 4.7: (continued)

	LOCATION #OH22									
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	APR-DEC
Resultant direction (0^{o} as North)	99	103	238	138	113	123	118	114	122	117
Resultant speed (cm. s^{-1})	3.97	2.26	1.04	1.75	3.62	3.95	5.31	7.23	7.26	3.70
Average speed (cm. s^{-1})	6.95	5.00	4.77	5.64	5.32	7.06	7.42	8.74	9.43	6.59
Maximum speed (cm. s^{-1})	22	20	19	18	20	20	19	18	23	23
Persistence factor	0.57	0.45	0.22	0.31	0.68	0.56	0.72	0.83	0.77	0.56
Percentage of negligible* speed (% of recording period)	13	12	11	7	14	3	4	2	2	8
Percentage of time going in direction of resultant	61	42	21	29	49	50	65	72	69	51
Interval of readings (min)	30	30	30	30	30	30	30	30	30	30

* $<$ 1.0 cm. s^{-1}

TABLE 4.8: Statistical Summary of Current Meter Operations, Offshore of Nanticoke, Lake Erie, 1977

	LOCATION				
	0205			0217	
	PERIOD				
	JUL	AUG	SEP	OCT	NOV
Resultant direction (0^o as North)	305	87	28	51	66
Resultant speed (cm. s^{-1})	2.19	3.15	2.03	2.64	1.59
Average speed (cm. s^{-1})	6.92	6.92	3.53	5.18	5.08
Maximum speed (cm. s^{-1})	17	21	36	75	23
Persistence factor	0.32	0.46	0.58	0.51	0.31
Percentage of negligible * speed (% of recording period)	N/A	N/A	7	9	7
Percentage of time going in direction of resultant	20	30	30	38	19
Total number of readings	720	2232	1584	4464	1947
Interval of readings (min)	20	20	10	10	10

* $<$ 0.30 cm. s^{-1}

TABLE 4.8: (cont'd)

	LOCATION #OH22									
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	APR-DEC
Resultant direction (0^{o} as North)	103	83	74	76	84	109	114	128	120	104
Resultant speed (cm. s^{-1})	2.02	0.98	1.93	0.96	2.86	1.84	1.92	4.02	4.23	2.09
Average speed (cm. s^{-1})	4.22	2.81	3.30	4.15	4.69	4.83	5.97	7.43	8.96	4.98
Maximum speed (cm. s^{-1})	25	15	16	17	15	19	28	19	32	32
Persistence factor	0.48	0.35	0.59	0.23	0.61	0.38	0.32	0.54	0.47	0.42
Percentage of negligible* speed (% of recording period)	26	28	25	13	11	13	12	4	6	16
Percentage of time going in direction of resultant	44	36	39	36	54	42	42	37	44	37
Interval of readings (min)	30	30	30	30	30	30	30	30	30	30

* < 1.0 cm. s^{-1}

TABLE 4.9: Statistical Summary of Current Meter Operations, Under Stelco Dock Bridges, Nanticoke, Lake Erie, July 25 to August 18, 1978

	LOCATION	
	0218 OFFSHORE	0219 NEARSHORE
Resultant direction (0^o as North)	347	339
Resultant speed ($cm.s^{-1}$)	0.38	0.88
Average speed ($cm.s^{-1}$)	4.13	1.47
Maximum speed ($cm.s^{-1}$)	26	11
Persistence Factor	0.09	0.60
Percentage of negligible* speed (% of recording period)	29	38
Total number of readings	3441	3444
Interval of readings (mins)	10	10

* $< 0.30\ cm.s^{-1}$

TABLE 4.9: (continued)

	LOCATION #OH22				
	JUN	JUL	AUG	SEP	JUN-SEP
Resultant direction (0^{o} as North)	134	196	131	143	150
Resultant speed ($cm.s^{-1}$)	0.85	2.65	6.38	8.08	3.51
Average speed ($cm.s^{-1}$)	7.74	9.99	8.85	10.35	10.63
Maximum speed ($cm.s^{-1}$)	29	23	23	22	29
Persistence Factor	0.11	0.27	0.72	0.78	0.33
Percentage of negligible* speed (% of recording period)	1	1	7	1	3
Percentage of time going in direction of resultant	13	15	41	47	27
Interval of readings (mins)	30	30	30	30	30

* $<$ 1.00 $cm.s^{-1}$

TABLE 5: NET WATER MOVEMENTS DIRECTIONS

OFFSHORE LOCATIONS # 0201, 0202, 0203, 0204, 0206, 0208, 0209, 0211, 0212

	Total No. of Water Movement Records	North		East		South		West	
		# of Times	% of Total	# of Times	% of Total	# of Times	% of Total	# of Times	% of Total
1968	9			9	100				
1969	8			4	50	2	25	2	25
1970	2			1	50			1	50
1973	3							3	100
1974	12	3	25	9	75				
1975	16	3	19	10	63	1	6	2	12
1968-1978	50	6	12	33	66	3	6	8	16

TABLE 5: (cont'd)

NEARSHORE LOCATIONS # 0205, 0207, 0210, 0213, 0214, 0217, 0218, 0219, OH11, OH22

	Total No. of Water Movement Records	North		East		South		West	
		# of Times	% of Total	# of Times	% of Total	# of Times	% of Total	# of Times	% of Total
1973	1					1	100		
1974	5			3	60	2	40		
1975	6			1				5	
1976	19	1	5	10	53	6	32	2	10
1977	14	1	7	12	86			1	7
1978	6			2	33	4	67		
1973-1978	51	2	4	28	55	13	25	8	16
ALL LOCATIONS = (OFFSHORE + NEARSHORE) LOCATIONS									
1968-1978	101	8	8	62	61	15	15	16	16

TABLE 6.1: SUMMARY OF CURRENTS OFFSHORE OF NANTICOKE G.S. SITE, LAKE ERIE 1968-78

LOCATION CODE	YEAR	PERIOD OF RECORD	NO. OF HOURS	DIRECTION "TO" BY QUADRANTS (PERCENT)						SPEED ($CM.S^{-1}$)			DIRECTION OF NET SPEED "TO" DEGREES
				C*	E	W	N	S	LONGSHORE E + W	MEAN	MAX.	NET	
0201	1968	Oct 1 - Nov 6	886	18.9	42.7	27.2	4.6	6.6	69.9	4.9	24.6	1.35	94
0202	1968	Aug 1 - Nov 27	2339	10.8	54.6	19.8	6.9	7.9	74.4	5.6	24.6	3.74	91
0203	1968	Sep 4 - Nov 27	1956	35.3	43.2	14.0	4.4	3.1	57.2	6.0	42.6	3.20	91
0201	1969	May 7 - Jul 31	2038	35.6	25.1	25.7	6.8	6.8	50.8	3.1	45.6	0.17	74
0202	1969	Jun 10 - Jul 31	1201	24.6	19.4	15.9	8.1	32.0	35.3	4.2	40.8	1.57	165
0208	1974	Apr 20 - Oct 24	2167	12.7	36.1	17.7	8.9	24.6	53.8	4.9	37.8	2.73	120
OH11	1974	Jun 19 - Dec 5	4051	3.4	30.0	10.7	40.9	15.0	79.4	6.4	27.1	3.35	52
0211	1975	May 9 - Nov 18	2689	7.9	43.4	14.4	20.3	14.0	57.8	5.6	33.7	2.70	67
0212	1975	May 9 - Nov 19	2900	6.8	49.2	14.2	13.5	16.3	63.4	5.4	43.2	3.20	99
OH22	1976	Apr 8 - Dec 20	6037	7.5	56.1	16.5	5.5	14.4	72.6	6.6	23.4	3.70	117
0217	1977	Sep 20 - Nov 19	1332	8.0	34.4	19.5	29.7	8.4	53.9	4.8	74.6	2.21	49
OH22	1977	Apr 15 - Dec 19	6187	15.5	50.2	15.9	10.1	8.3	66.1	5.0	32.2	2.09	104
OH22	1978	Jun 8 - Sep 9	2176	2.9	35.5	24.5	8.3	28.8	60.0	9.1	28.5	3.61	147
Weighted Mean				12.6	43.3	16.9	13.5	13.7	60.2	5.7	33.8	-	-

*C = calm <0.3 $cm.s^{-1}$

TABLE 6.2: SUMMARY OF CURRENTS IN THE VICINITY OF NANTICOKE G.S. OUTFALL & PEACOCK POINT, LAKE ERIE 1973-77

LOCATION CODE	YEAR	PERIOD OF RECORD	NO. OF HOURS	DIRECTION "TO" BY QUADRANTS (PERCENT)						SPEED ($CM.S^{-1}$)			DIRECTION OF NET SPEED "TO" DEGREES
				C	E	W	N	S	LONGSHORE E + W	MEAN	MAX.	NET	
Outfall													
0205	1973	Jul 19 - Aug 11	542	18.5	16.3	27.0	8.2	30.0	43.3	3.5	17.7	1.32	196
0207	1974	Aug 8 - Nov 27	2514	13.1	30.5	13.7	19.0	23.7	44.2	2.6	33.6	0.79	92
0205	1977	Jul 22 - Aug 31	984	0.0	41.4	15.0	24.7	18.9	56.4	6.9	21.4	1.99	77
Weighted Mean				10.6	31.3	15.8	18.9	23.4	47.1	3.8	28.5	-	-
Peacock Point													
206	1973	Jul 20 - Sep 18	1441	63.0	7.2	16.3	7.1	6.4	23.5	1.3	22.6	0.43	286

TABLE 6.3: SUMMARY OF CURRENTS IN THE VICINITY OF STELCO DOCK & CENTRE CREEK, LAKE ERIE, 1975-78

LOCATION CODE	YEAR	PERIOD OF RECORD	NO. OF HOURS	DIRECTION "TO" BY QUADRANTS (PERCENT)						SPEED ($CM.S^{-1}$)			DIRECTION OF NET SPEED "TO" DEGREES
				C	E	W	N	S	LONGSHORE E + W	MEAN	MAX.	NET	
Stelco Dock													
0210	1975	May 9 - Nov 1	3378	0.0	34.9	42.5	11.9	10.7	77.4	8.1	56.9	2.89	274
0213	1976	May 21 - Oct 19	3639	10.4	23.2	19.3	21.1	26.0	42.5	3.4	18.4	0.22	148
0214	1976	May 21 - Aug 31	2472	26.7	14.5	29.2	9.7	19.9	43.7	1.8	15.7	0.82	246
0218	1978	Jul 25 - Aug 18	574	28.9	31.5	25.5	5.0	9.1	57.0	4.1	26.2	0.38	347
0219	1978	Jul 25 - Aug 18	574	38.1	16.5	10.9	10.3	24.2	27.4	1.5	11.4	0.88	339
Weighted Mean				13.4	25.0	28.8	14.1	18.7	53.8	4.5	30.0	-	-
West of Centre Creek													
0204	1969	May 8 - Jul 31	2029	31.4	36.6	16.8	6.4	8.8	53.4	4.5	48.0	2.32	102
0209	1975	May 9 - Nov 10	2329	0.0	31.6	31.2	18.4	18.8	62.8	10.8	37.3	0.61	338
Weighted Mean				14.6	33.9	24.5	12.8	14.2	58.4	7.9	42.3	-	-

TABLE 7: COMPARISON OF WATER MOVEMENT RESULTS, NANTICOKE REGION, LAKE ERIE 1968-1978

Location Code	Period	Resultant Direction Coming from 0° as North	Percentage of Time Going			Percentage of Negligible (<0.3 cm.s^{-1}) Currents	Max. Percentage Occurrence in any Speed Class Range (except negligible)	Mean of Speed Class Range with Max. Occurrence (cm.s^{-1})	Mean Speed in direction of Resultant (cm.s^{-1})	Distance Travelled Along Resultant (in 10 h) (km)	Mean of Distance Travelled (in 10 h) (km)	Standard Deviation of Distance Travelled (km)
			In direction of Resultant	Opposite to Resultant	Along the Resultant Axis							
0202	Aug 68	262	40	14	54	15	27	4.5	6.2	2.2		
0202	Sep 68	277	45	23	68	10	33	4.5	5.1	1.8		
0203	Sep 68	277	52	11	63	54	25	1.7	2.7	1.0		
0201	Oct 68	272	44	26	70	18	25	4.5	7.2	2.6		
0202	Oct 68	271	59	17	76	10	20	4.5	9.8	3.5	2.62	1.29
0203	Oct 68	268	52	11	63	31	22	1.7	6.2	2.2		
0201	Nov 68	298	36	26	62	28	27	4.5	3.7	1.3		
0202	Nov 68	273	85	0	85	1	23	4.5	13.2	4.7		
0203	Nov 68	273	59	22	81	21	20	4.5	12.0	4.3		
0201	May 69	256	43	13	56	36	21	1.7	6.2	2.2	2.21	1.18
0204	May 69	278	50	16	66	31	16	7.5	9.0	3.2		
0201	Jun 69	74	33	28	61	38	25	1.7	3.1	1.1		
0202	Jun 69	255	24	9	33	24	25	4.5	5.0	1.8	1.95	0.96
0204	Jun 69	276	38	9	47	28	21	4.5	9.6	3.5		
0201	Jul 69	67	22	15	37	29	29	1.7	3.5	1.3		
0202	Jul 69	15	54	1	55	25	22	4.5	4.6	1.7		
0204	Jul 69	18	12	7	19	35	22	1.7	2.2	0.8		
0201	Feb 70	255	40	25	65	41	20	4.5	6.8	2.5	1.45	1.48
0201	Mar 70	69	33	12	45	74	10	4.5	1.1	0.4		
0205	Jul 73	16	16	7	23	19	23	1.7	3.5	1.3		
0206	Jul 73	125	10	4	14	57	15	1.2	1.6	0.6		
0206	Aug 73	77	28	11	39	74	15	1.2	0.7	0.3	0.79	0.42
0206	Sep 73	107	25	12	37	48	15	3.0	2.7	1.0		
0208	Apr 74	306	50	1	51	15	16	1.5	5.8	2.1		
0208	May 74	300	30	9	39	4	15	4.0	6.8	2.4		
0208	Jun 74	305	42	8	50	30	20	1.7	4.6	1.7		
0208	Jul 74	287	18	13	31	3	17	3.0	15.4	5.5		
0207	Aug 74	35	27	15	42	18	19	1.5	4.1	1.5	2.23	1.35
0207	Sep 74	295	17	5	22	15	21	1.5	2.2	0.8		
0207	Oct 74A	245	35	5	40	6	31	1.5	5.0	1.8		
0207	Oct 74B	255	26	7	33	10	22	1.5	4.4	1.6		
0208	Oct 74	301	49	2	51	2	21	3.0	9.7	3.5		
0208	Nov 74	255	26	10	36	10	36	1.7	3.8	1.4		
0209	May 75	204	17	6	23		49	11.0	13.0	4.7		
0210	May 75	90	40	20	60		17	4.5	7.9	2.8		
0211	May 75	229	24	12	36	11	19	1.7	8.4	3.0		
0212	May 75	264	37	5	42	9	13	1.5	6.9	2.5		
0209	Jun 75	157	8	7	15		23	12.5	13.8	5.0		
0210	Jun 75	113	15	19	34		15	5.0	9.0	3.2		
0211	Jun 75	224	36	7	43	3	12	5.0	14.2	5.1		
0210	Jul 75	284	48	0	48		4	2.5	2.3	0.8		
0212	Jul 75	276	52	3	55	6	13	3.5	4.6	1.7		
0209	Sep 75	98	44	18	62		16	7.0	12.5	4.5		
0210	Sep 75	98	58	15	73		17	5.0	14.2	5.1	3.49	1.54
0211	Sep 75	271	41	5	46	7	24	3.0	5.2	1.9		
0212	Sep 75	276	49	15	64	3	17	3.0	7.5	2.7		
0209	Oct 75	100	31	23	54		15	7.0	16.0	5.8		
0210	Oct 75	101	50	17	67		22	7.0	15.2	5.5		
0211	Oct 75	260	29	9	38	11	14	1.5	6.4	2.3		
0212	Oct 75	290	25	13	38	5	21	3.0	7.2	2.6		
0209	Nov 75	323	46	2	48		18	2.5	5.2	1.9		
0210	Nov 75	90	71	8	79		21	10.5	17.1	6.2		
0211	Nov 75	270	44	4	48	6	26	1.2	7.5	2.7		
0212	Nov 75	290	35	6	41	5	30	1.7	12.5	4.5		
0213	May 76	261	40	0	40	14	22	1.5	3.0	1.1		
0214	May 76	345	45	9	54	34	25	0.7	1.5	0.5		
0213	Jun 76	139	35	5	40	16	24	9.0	4.5	1.6		
0214	Jun 76	43	8	14	22	30	19	0.7	2.8	1.0		
0213	Jul 76	283	18	8	26	6	23	9.0	4.0	1.4		
0214	Jul 76	83	34	13	47	20	20	1.5	4.1	1.5	1.31	0.40
0213	Aug 76	312	18	7	25	15	19	8.0	3.4	1.2		
0214	Aug 76	69	24	12	36	28	20	1.5	3.4	1.2		
0213	Sep 76	346	18	10	28	6	30	3.0	4.6	1.7		
0214	Oct 76	40	20	10	30	6	32	9.5	5.4	1.9		
0205	Jul 77	125	20	7	27	2	17	5.5	8.9	3.2		
0205	Aug 77	267	30	5	35	8	28	6.0	6.9	2.5		
0217	Sep 77	205	30	4	34	7	29	3.0	3.7	1.3	2.48	0.82
0217	Oct 77	231	38	10	48	9	39	2.2	5.9	2.1		
0217	Nov 77	246	20	18	38	7	27	1.7	9.2	3.3		
0218	Aug 78	167	6	5	11	29	22	1.7	2.2	0.8	1.05	0.35
0219	Aug 78	159	16	12	28	38	21	0.7	3.6	1.3		

TABLE 8.1: COMPARISON OF SPECTRAL RESULTS, OFFSHORE LOCATIONS*, NANTICOKE, LAKE ERIE, 1968-75
NUMBER OF OCCURRENCES OF SIGNIFICANT SPECTRAL PERIODS OF WATER MOVEMENTS

SIGNIFICANT SPECTRAL PERIODS (h)	1968		1969		1970		1973		1974		1975	
	N	E	N	E	N	E	N	E	N	E	N	E
60					2	2						
24	2											
22	1											
20	1	1	1	1								
17			1									
16		1										
15	1					1			1	1		
14		1	1									
13	1											1
12	1		1			1					1	
11	4		1								2	2
10												1
9		1			1	2		1			3	2
8	1				1	1						
7	2										2	2
6	3							1	2		4	2
5	2											5
4							1	1	1		8	7
3							1	1	4		13	8
2							1	2	1		10	8
No. of Monthly Datasets	4		3		2		3		5		16	

* Offshore Locations #0201, 0202, 0203, 0204, 0206, 0208, 0209, 0211 & 0212

TABLE 8.2: COMPARISON OF SPECTRAL RESULTS, NEARSHORE LOCATIONS*, NANTICOKE, LAKE ERIE, 1973-77 NUMBER OF OCCURRENCES OF SIGNIFICANT SPECTRAL PERIODS OF WATER MOVEMENTS

SIGNIFICANT SPECTRAL PERIODS (h)	1973		1974		1975		1976		1977	
	N	E	N	E	N	E	N	E	N	E
24					1					
22										
20										
17								1		
16										
15										
14										
13							1			
12			1	1				1		
11			1							
10								1	1	
9		1	1	2						
8					2		2	1	1	
7							1			
6		1			1		2	3		1
5			2	1	2		2	1	1	
4	1	1	2	2	5		4	5		2
3	1	1		2	6		5	3	3	
2	1	2		1	4	3	5	3		2
No. of Monthly Datasets	1		4		6		10		5	

* Nearshore Locations # 0205, 0207, 0210, 0213, 0214, 0217, 0218, & 0219

TABLE 9: SUMMARY OF COHERENCES, CROSS-CORRELATIONS

PERIOD	FACTOR A (CURRENTS AT LOCATIONS)	FACTOR B	PERIODS WITH 5% SIGNIFICANT COHERENCES (h) NORTH - SOUTH	EAST - WEST
Aug 68	0202	Wind	None	17.0, 8.7
	0202	Water Level	None	16.5, 12.0, 7.0, 3.8
Sep 68	0203	Wind	39.0	55.0
	0203	Currents at 0202	None	26.0, 15.0
	0203	Water Level	None	2.4
Oct 68	0203	Wind	None	None
	0203	Currents at 0202	None	None
Nov 68	0203	Wind	None	32.0, 12.0
	0203	Currents at 0202	6.4, 5.0, 3.8	24.0, 4.2
	0203	Water Level	None	None
May 69	0201	Wind	20.0, 3.6	40.0
	0201	Currents at 0204	None	40.0, 12.0
	0204	Wind	None	40.0, 20.0
Jun 69	0201	Wind	30.0, 4.4	40.0, 30.0, 24.0, 3.6
	0201	Currents at 0204	None	24.0, 20.0
	0204	Wind	None	40.0, 24.0
Jul 69	0201	Wind	40.0	40.0, 20.0
	0201	Currents at 0204	None	20.0, 5.2
	0204	Wind	15.0	20.0

TABLE 10: Statistical Summary of Wind at Nanticoke, G.S., Lake Erie 1968-78

Period	Resultant Direction Going to 0^o as North	Resultant Speed ($km.h^{-1}$)	Average Speed ($km.h^{-1}$)	Maximum Speed ($km.h^{-1}$)	Persistence Factor
Aug 68	77	7.3	16.3	38.6	0.45
Sep 68	33	6.2	16.7	48.3	0.37
Oct 68	58	8.5	18.8	53.1	0.45
Nov 68	109	7.9	22.0	67.6	0.36
May 69	65	4.6	16.7	69.2	0.27
Jun 69	46	7.2	15.4	46.7	0.47
Jul 69	30	3.0	14.7	51.5	0.20
Jan 70	87	11.3	19.3	54.7	0.59
Feb 70	72	11.4	21.8	54.7	0.52
Mar 70	122	6.0	19.0	77.3	0.32
Jul 73	45	4.6	14.3	40.2	0.32
Aug 73	60	4.5	13.5	54.7	0.33
Sep 73	81	4.9	15.8	48.3	0.31
Apr 74	72	9.2	20.2	64.4	0.46
May 74	78	5.2	18.0	45.1	0.29
Jun 74	157	2.1	15.3	41.8	0.13
Jul 74	68	8.3	15.8	51.5	0.53
Aug 74	37	6.7	15.4	56.3	0.44
Sep 74	62	8.9	18.0	57.9	0.50
Oct 74	76	10.8	18.0	49.9	0.60
Nov 74	84	9.6	20.5	77.3	0.47
Dec 74	296	3.2	3.4	8.1	0.94
May 75	77	3.5	12.2	40.2	0.29
Jun 75	45	5.0	15.7	46.7	0.31
Jul 75	56	9.7	15.3	41.8	0.63
Aug 75	59	5.0	16.6	48.3	0.30
Sep 75	67	8.1	18.7	54.7	0.43
Oct 75	68	6.8	19.2	59.5	0.36
Nov 75	64	12.5	20.0	78.9	0.62
Apr 76	81	8.5	18.8	62.8	0.45
May 76	13	2.4	14.5	43.5	0.16
Jun 76	49	5.5	16.4	48.0	0.33
Jul 76	69	8.1	16.7	39.0	0.49
Aug 76	86	6.1	16.7	47.0	0.36
Sep 76	81	11.4	20.1	63.0	0.57
Oct 76	88	5.9	20.6	61.0	0.28
Nov 76	71	23.5	26.5	50.0	0.88
Dec 76	65	18.8	25.1	61.0	0.75
Apr 77	88	8.6	20.1	71.0	0.43
May 77	127	4.3	17.2	48.0	0.25
Jun 77	21	5.5	13.1	45.2	0.42
Jul 77	70	8.9	15.6	52.0	0.57
Aug 77	62	9.5	14.6	48.0	0.65
Sep 77	60	4.9	13.7	58.0	0.35
Oct 77	98	4.2	12.9	40.2	0.33
Nov 77	99	7.2	23.4	64.0	0.31
Dec 77	93	10.8	32.1	84.0	0.34
Jun 78	71	7.7	13.5	41.8	0.57
Jul 78	62	5.8	12.4	37.4	0.47
Aug 78	73	4.9	14.5	38.6	0.34
Sep 78	77	5.4	15.9	38.6	0.34

TABLE 11: SUMMARY OF WIND DIRECTION AND SPEED, NANTICOKE GENERATING STATION, LAKE ERIE, 1968-78

YEAR	PERIOD OF RECORD	NO. OF HOURS	C	DIRECTION "TO" BY QUADRANTS (PERCENT)					SPEED ($CM.S^{-1}$)			DIRECTION OF NET SPEED "TO" DEGREES
				E	W	N	S	LONGSHORE E + W	MEAN	MAX.	NET	
1968	Aug 8 - Nov 30	2690	0.6	39.7	17.9	17.2	24.6	57.6	18.6	67.6	6.68	71
1969	May 1 - Jul 31	2208	1.2	39.9	21.1	20.5	17.3	61.0	15.6	69.2	4.76	49
1973	Jul 1 - Sep 30	1819	3.7	35.5	18.2	16.7	25.9	53.7	14.6	54.7	4.51	63
1974	Apr 1 - Dec 5	5674	4.0	46.8	15.2	14.1	19.9	62.0	17.7	77.2	7.69	65
1975	May 1 - Nov 30	5111	4.3	49.2	15.2	14.7	16.6	64.4	16.8	78.9	7.14	62
1976	Apr 1 - Dec 21	5763	1.7	55.5	13.5	10.4	18.9	69.0	19.8	63.0	10.59	72
1977	Apr 1 - Dec 31	6574	1.0	45.0	19.7	14.0	20.3	64.7	18.3	84.0	7.21	82
1978	Jun 1 - Sep 30	2535	2.6	44.9	20.9	12.1	19.5	65.8	14.3	57.9	4.82	70
Weighted Mean			2.4	46.5	17.1	14.2	19.8	63.6	17.5	72.2	-	-

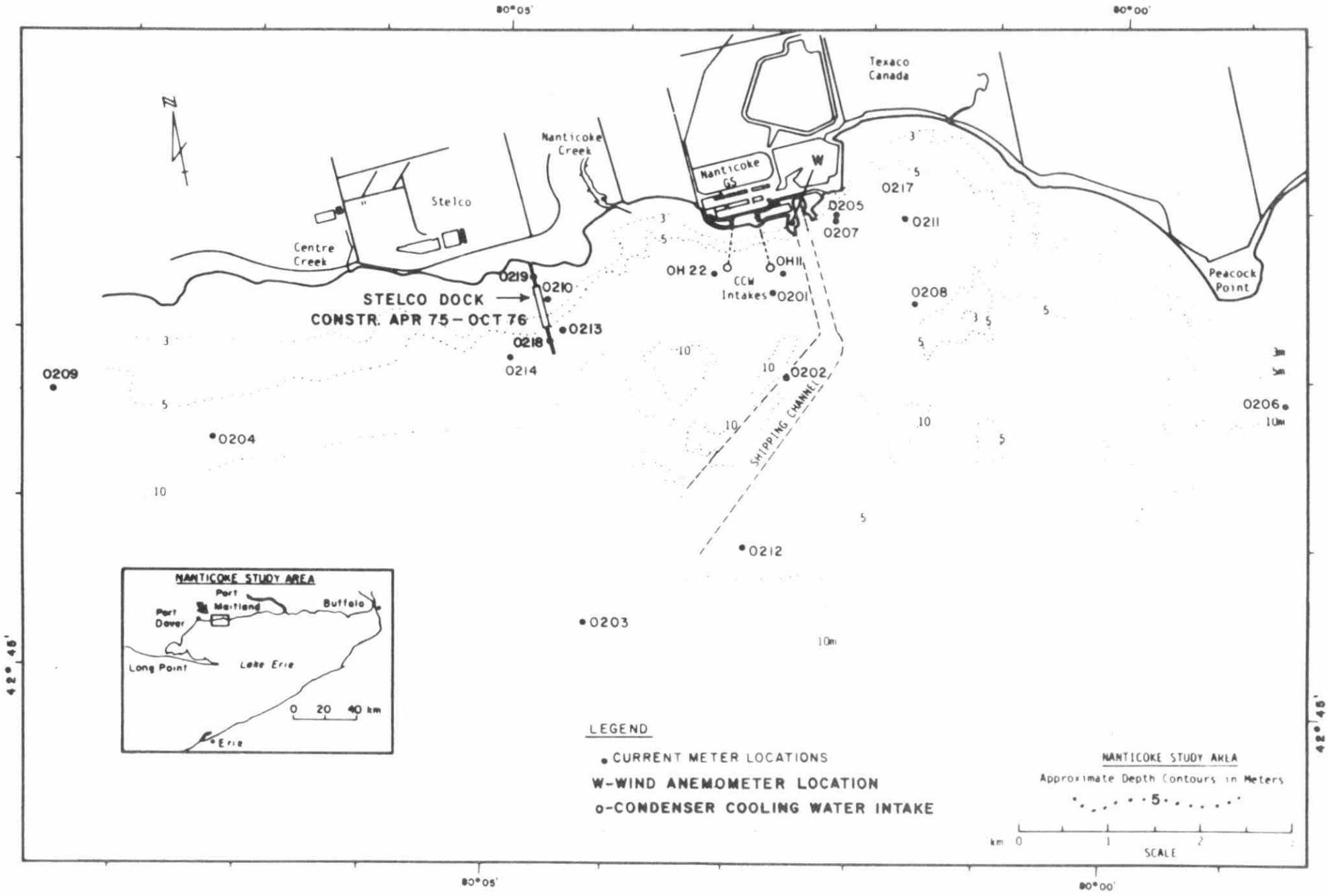


FIGURE 1 CURRENT METER LOCATIONS, NANTICOKE, LAKE ERIE, 1968-78.

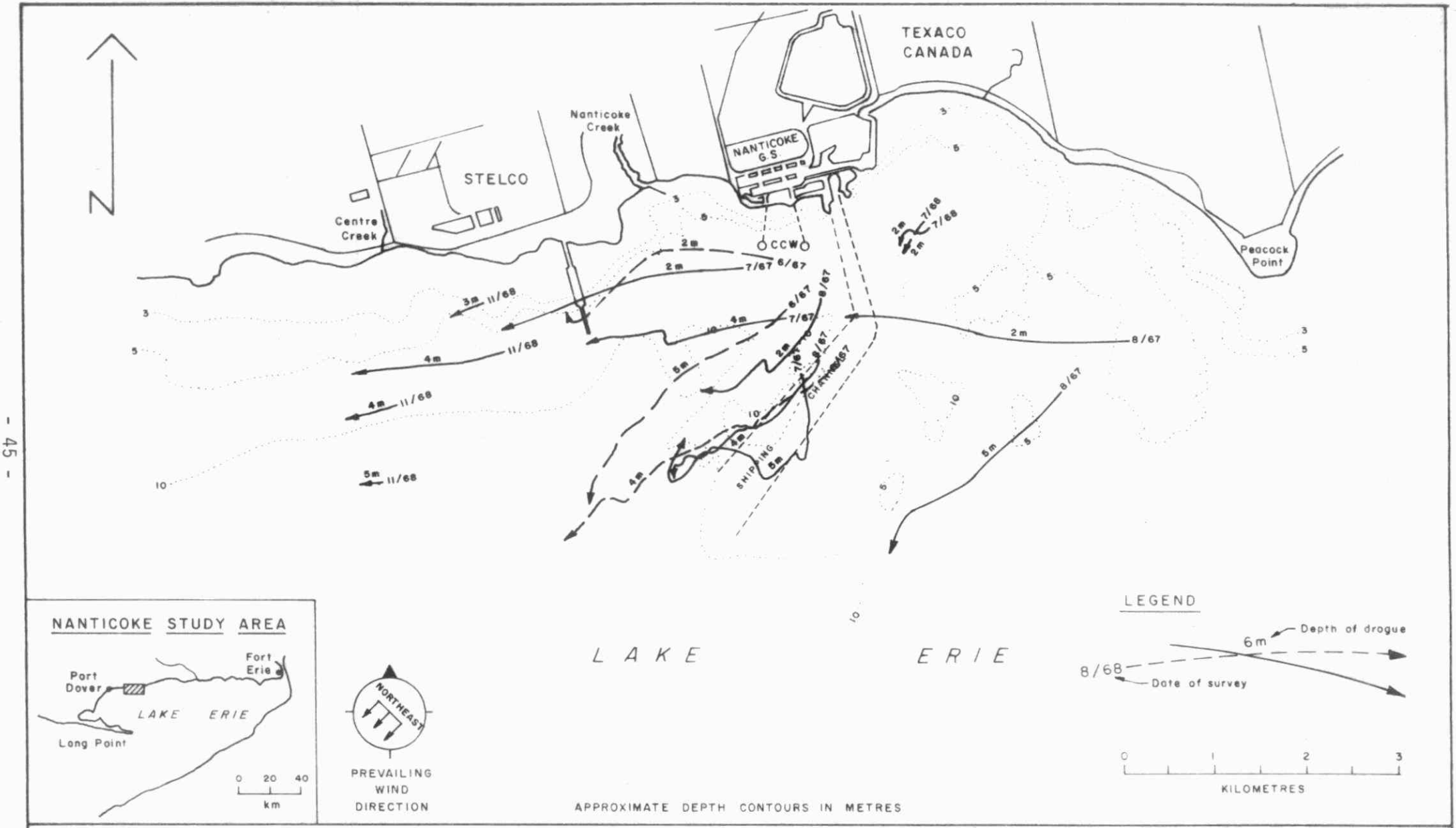


Fig. 2 LAKE ERIE — NANTICOKE G.S. DROGUE TRACKING (BY ONTARIO HYDRO)
NORTH-EAST WIND CURRENT PATTERN

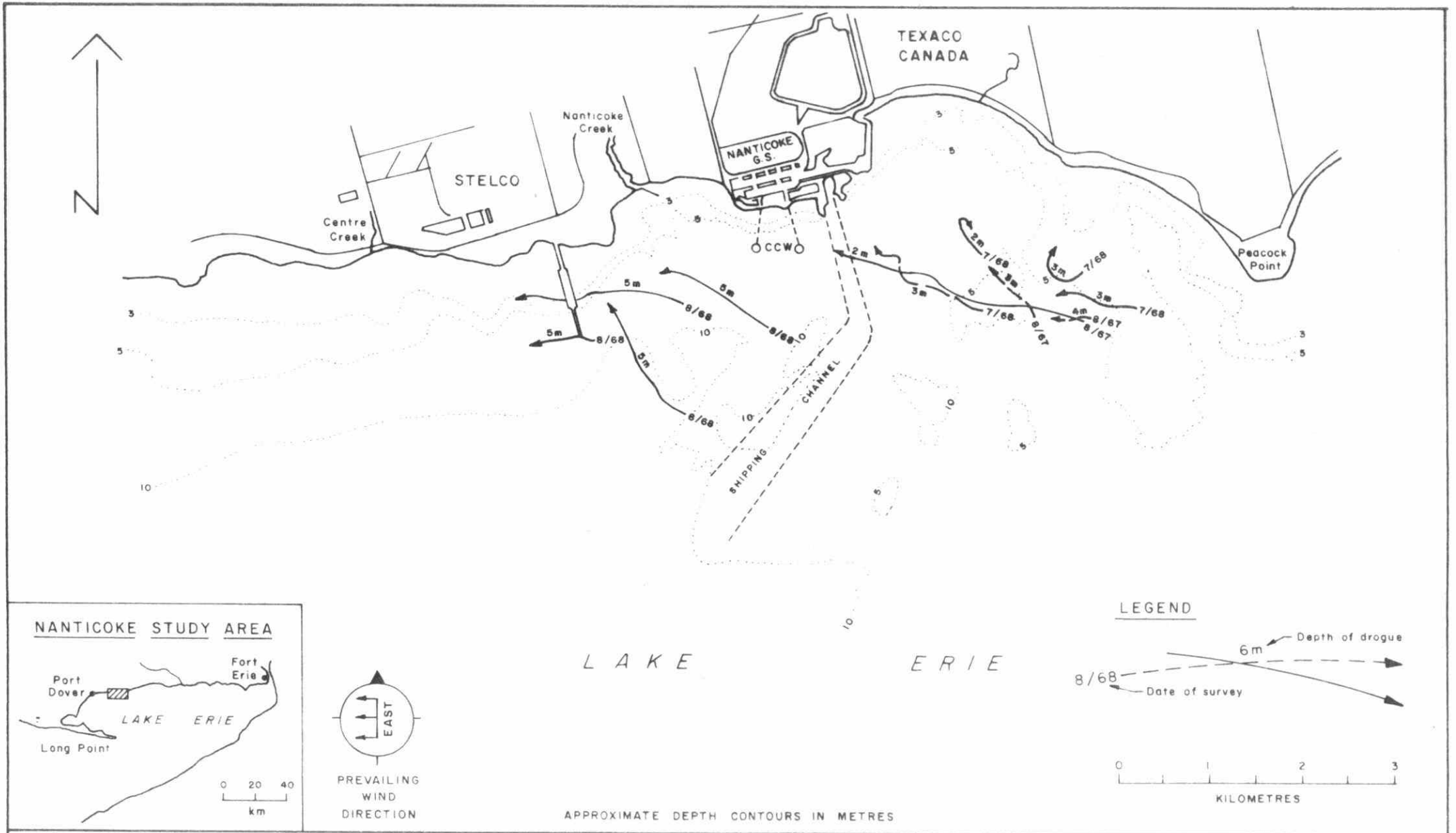


Fig. 3 LAKE ERIE — NANTICOKE G.S. DROGUE TRACKING (BY ONTARIO HYDRO)
EAST WIND CURRENT PATTERN

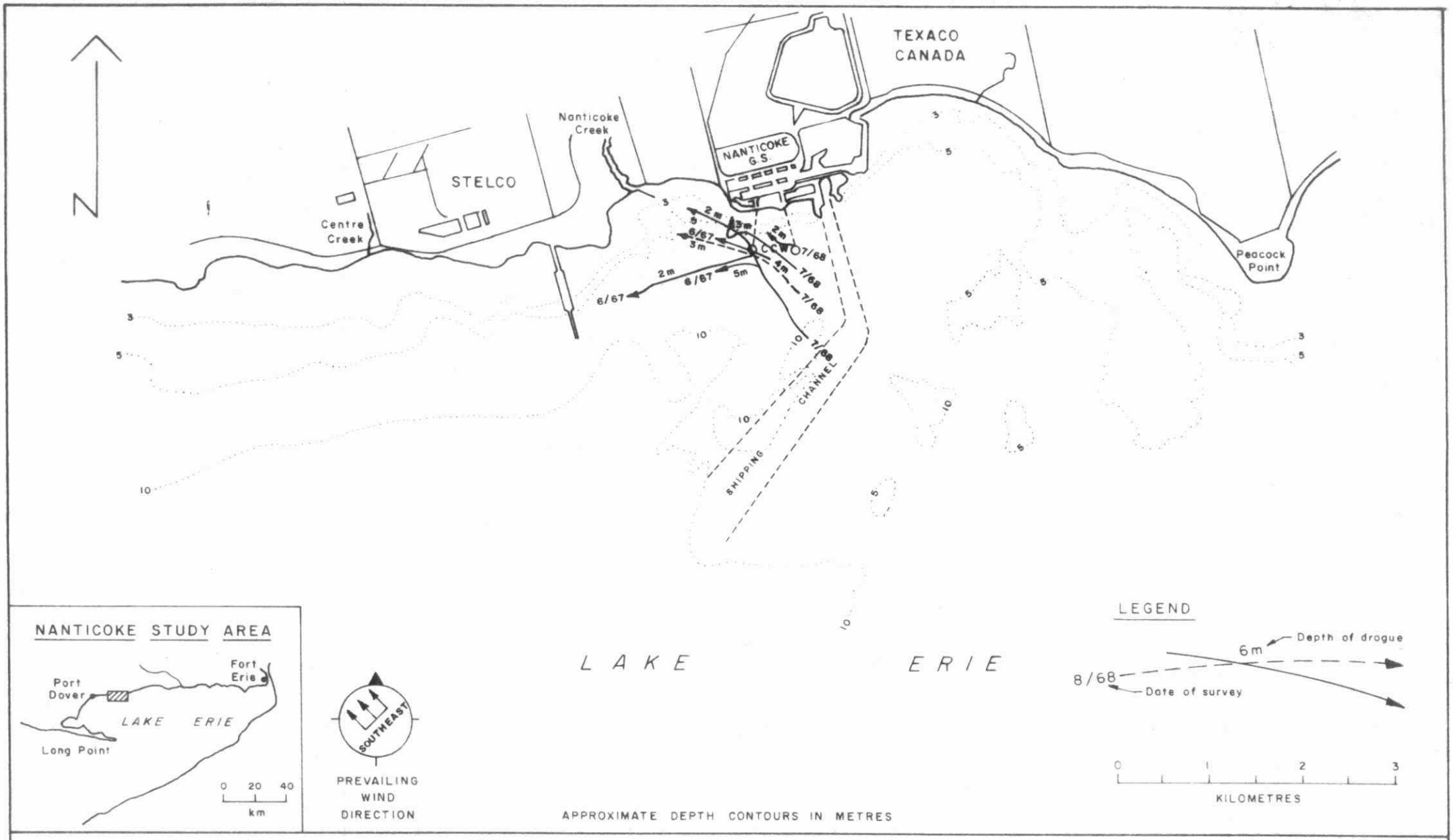


Fig. 4 LAKE ERIE — NANTICOKE G.S. DROGUE TRACKING (BY ONTARIO HYDRO)
SOUTH-EAST WIND CURRENT PATTERN

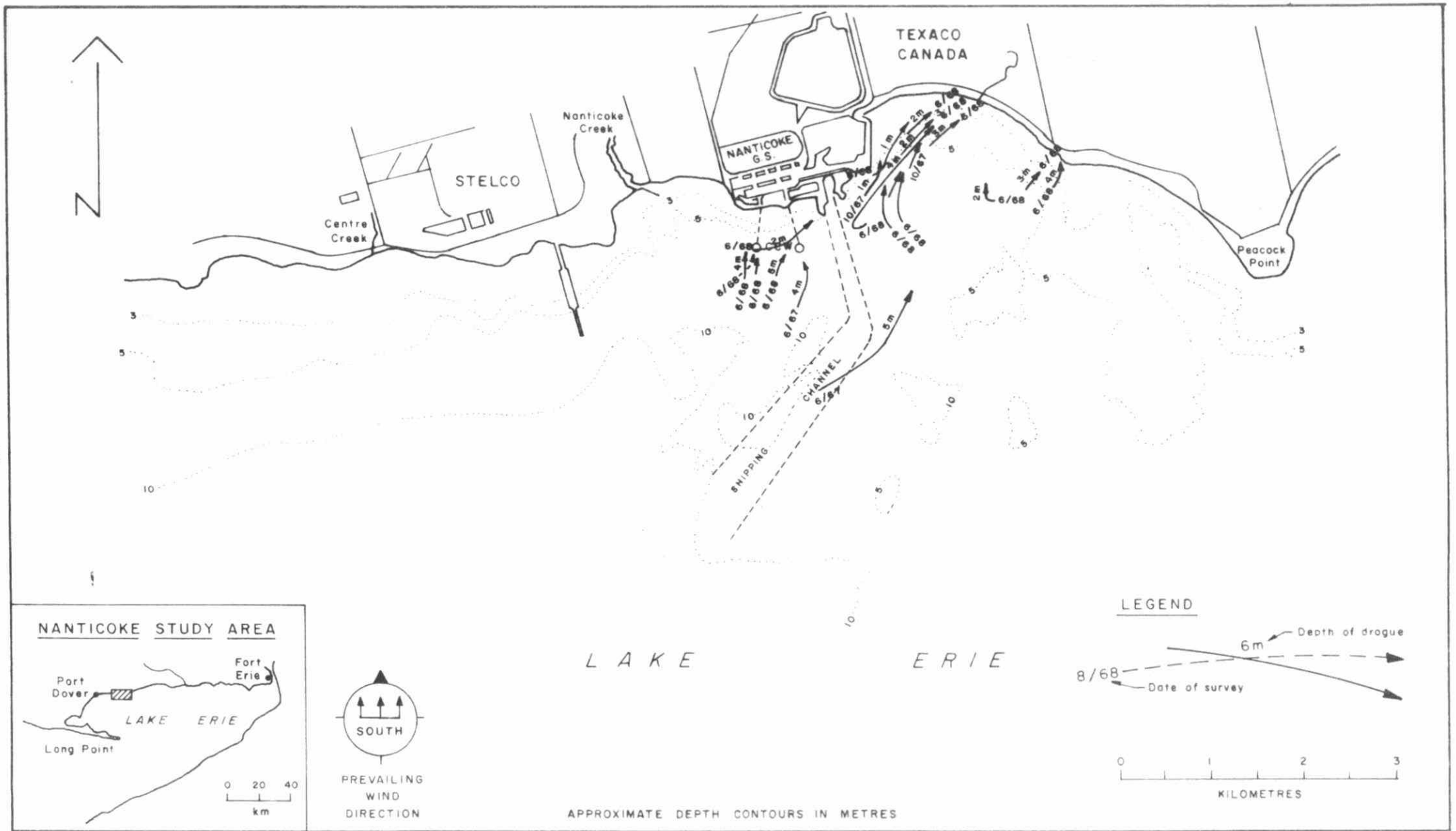


Fig. 5 LAKE ERIE — NANTICOKE G.S. DROGUE TRACKING (BY ONTARIO HYDRO)
SOUTH WIND CURRENT PATTERN

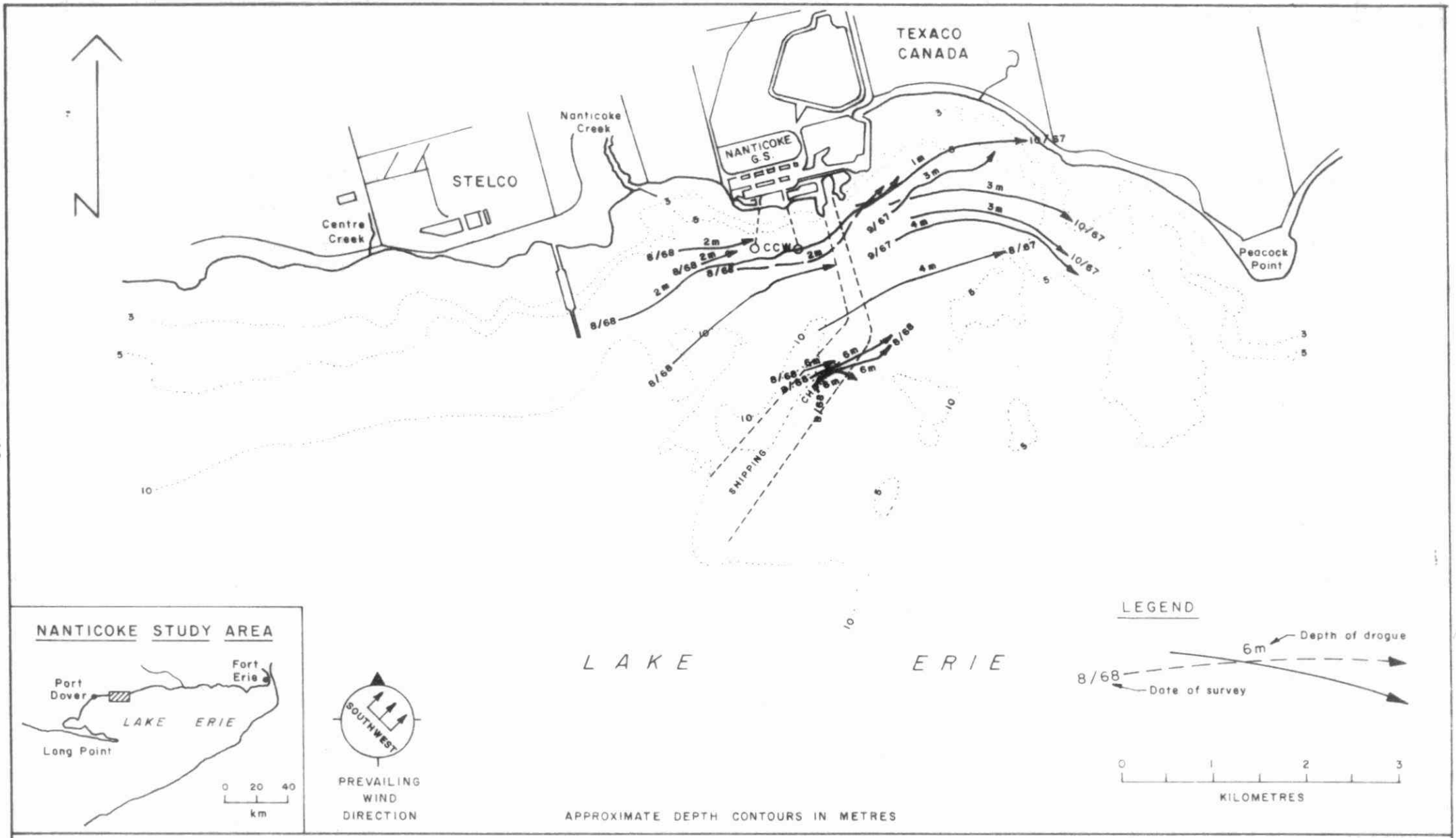


Fig. 6 LAKE ERIE — NANTICOKE G.S. DROGUE TRACKING (BY ONTARIO HYDRO)
SOUTH-WEST WIND CURRENT PATTERN

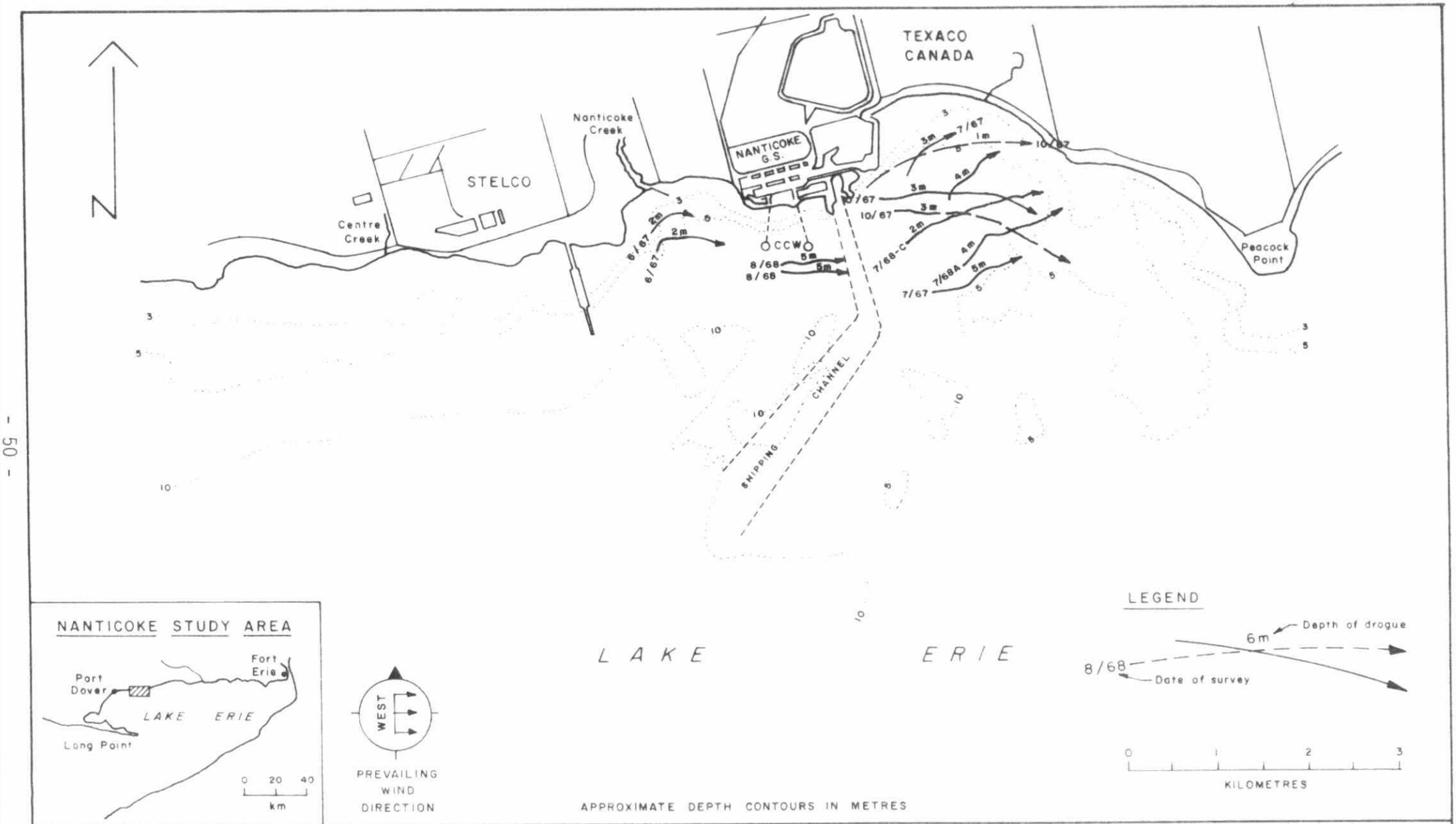


Fig. 7 LAKE ERIE — NANTICOKE G.S. DROGUE TRACKING (BY ONTARIO HYDRO)
WEST WIND CURRENT PATTERN

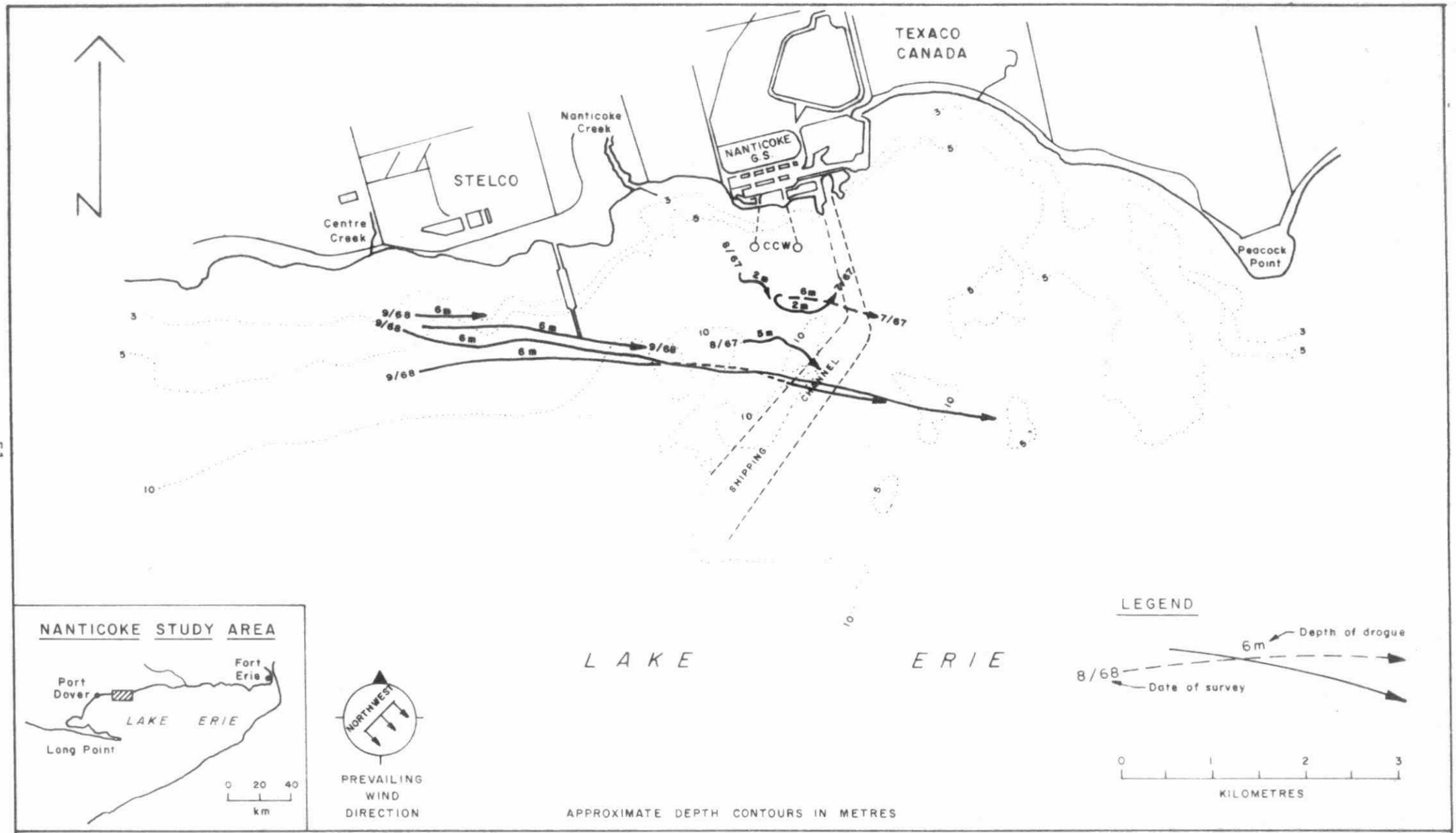


Fig. 8 LAKE ERIE — NANTICOKE G.S. DROGUE TRACKING (BY ONTARIO HYDRO)
NORTH-WEST WIND CURRENT PATTERN

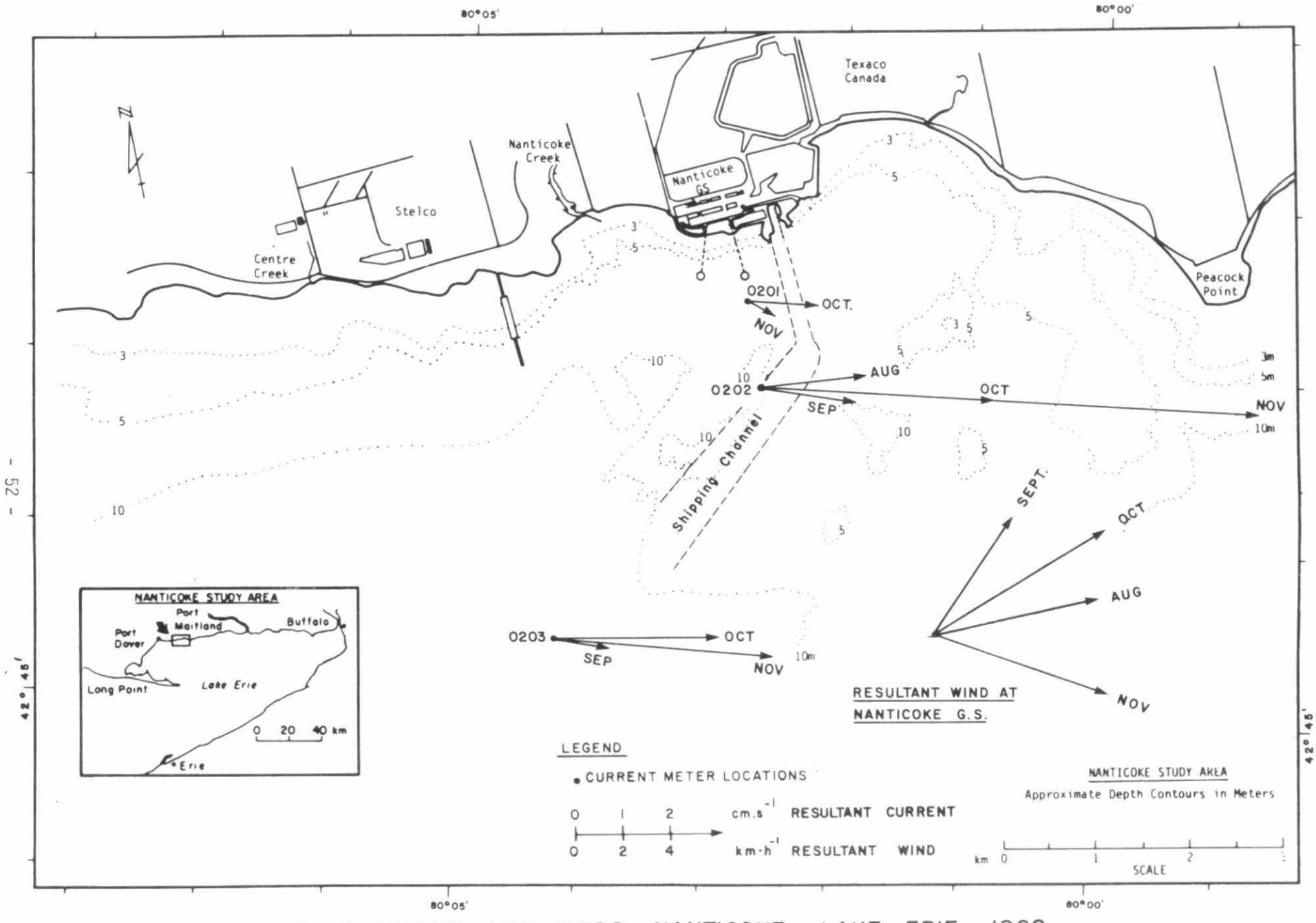


FIGURE 9 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1968.

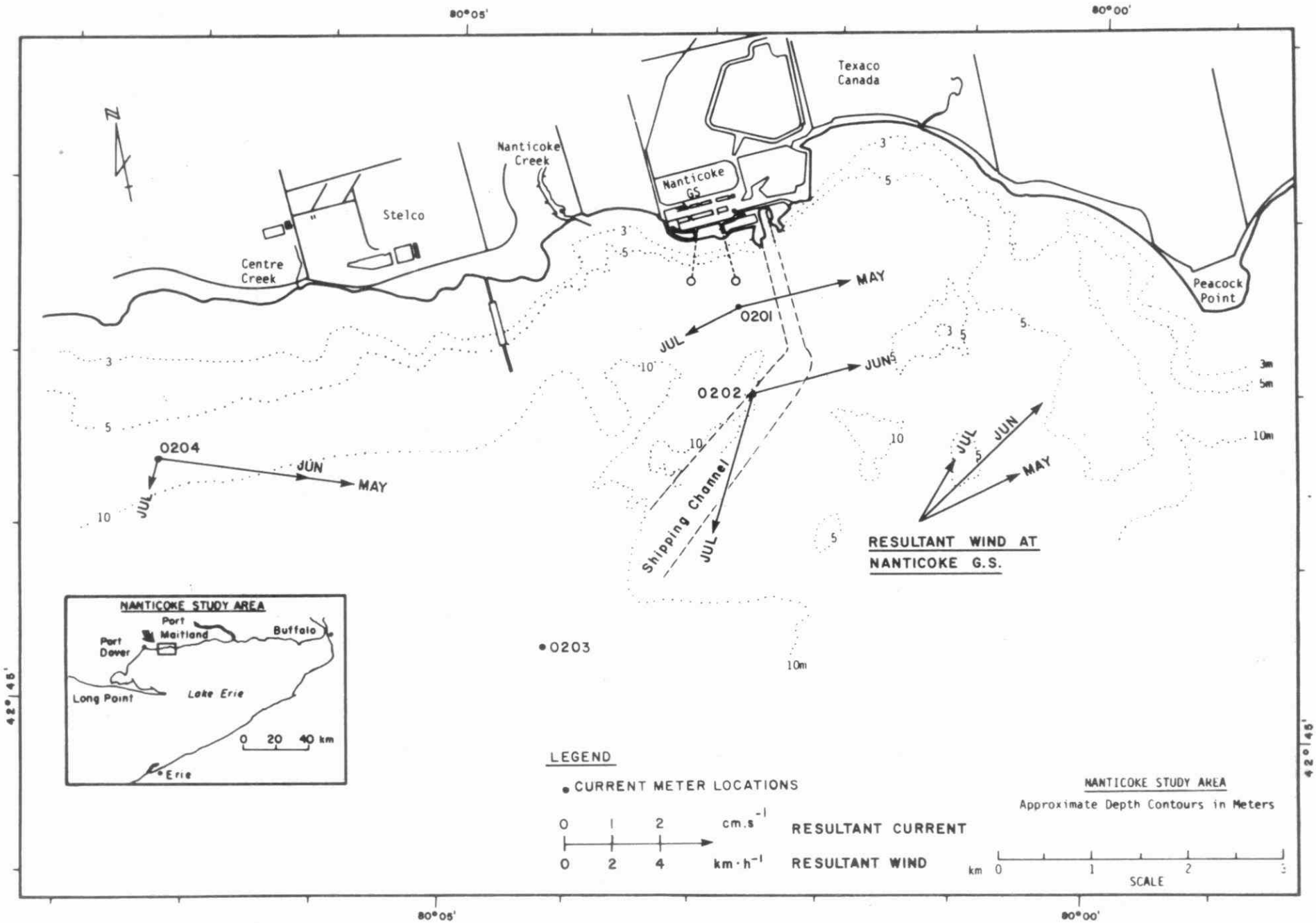


FIGURE 10 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1969.

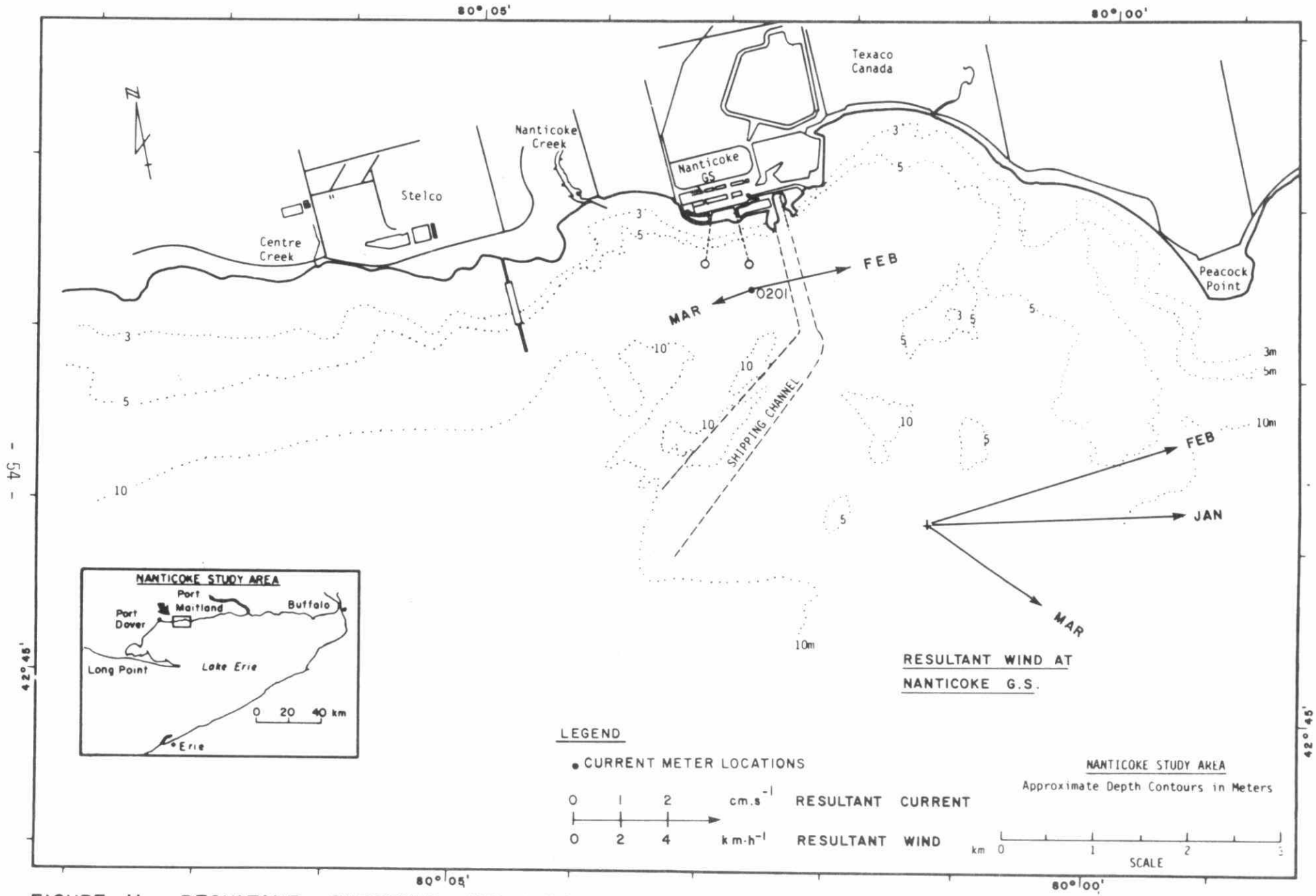


FIGURE 11 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1970.

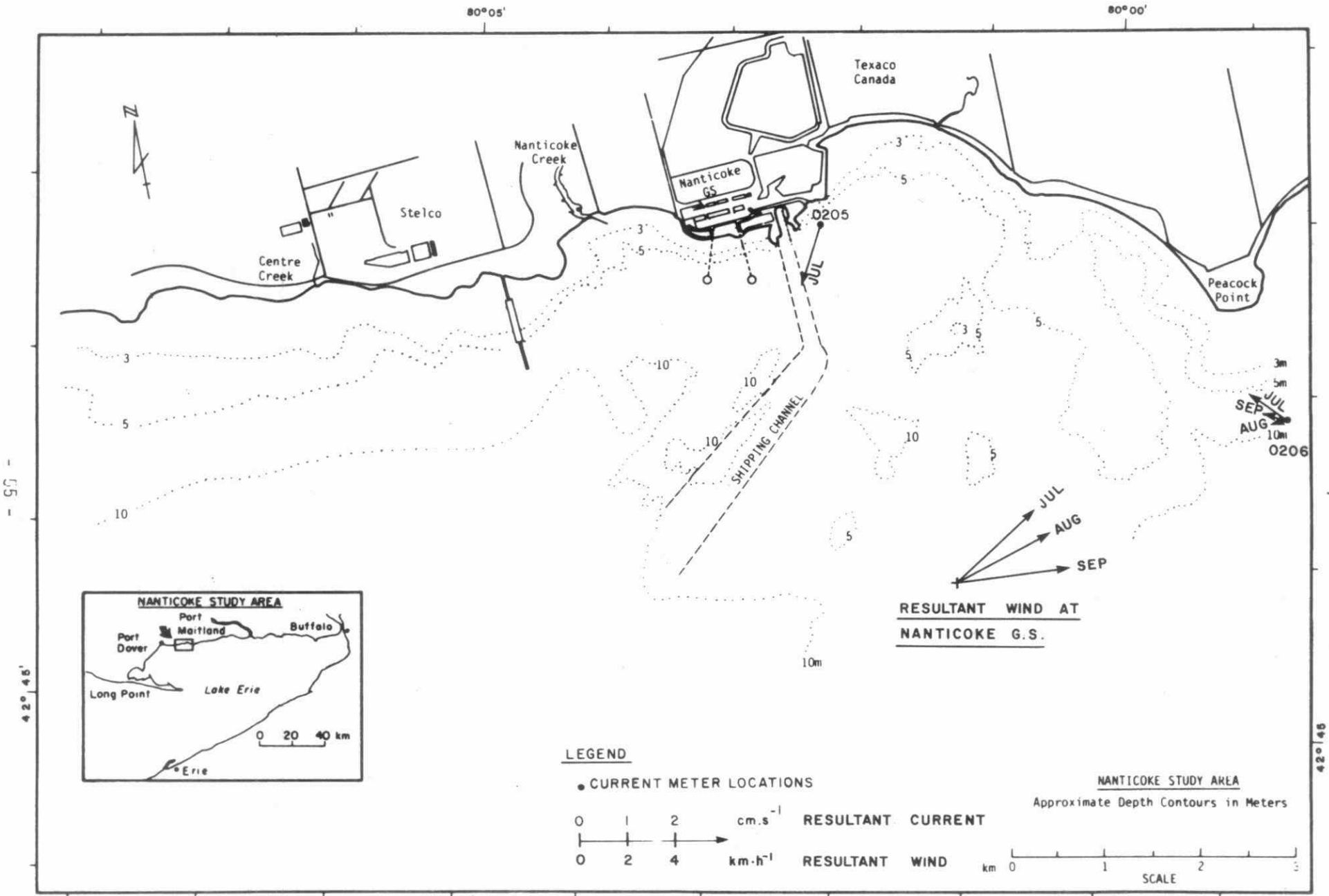


FIGURE 12 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1973.

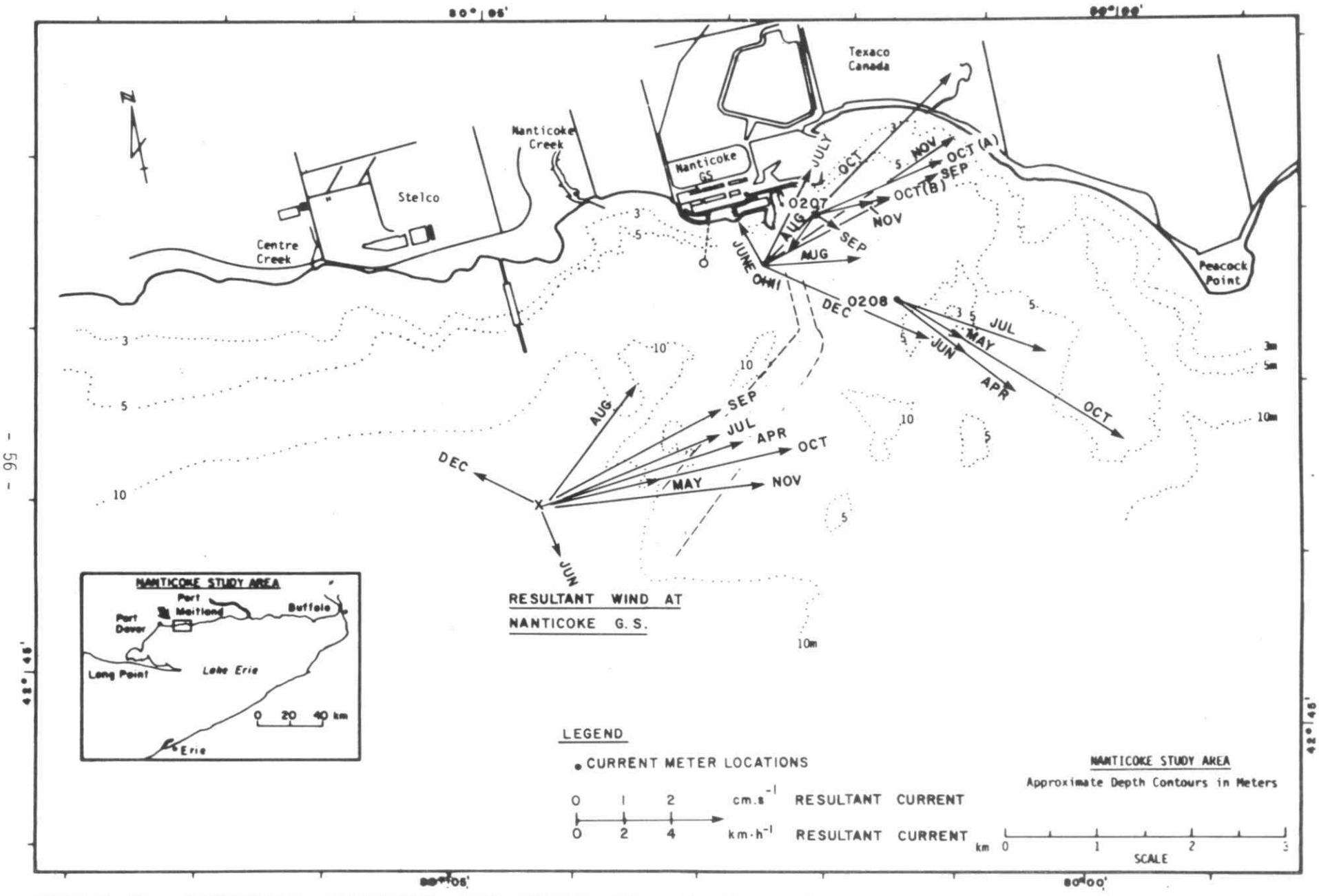


FIGURE 13 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1974.

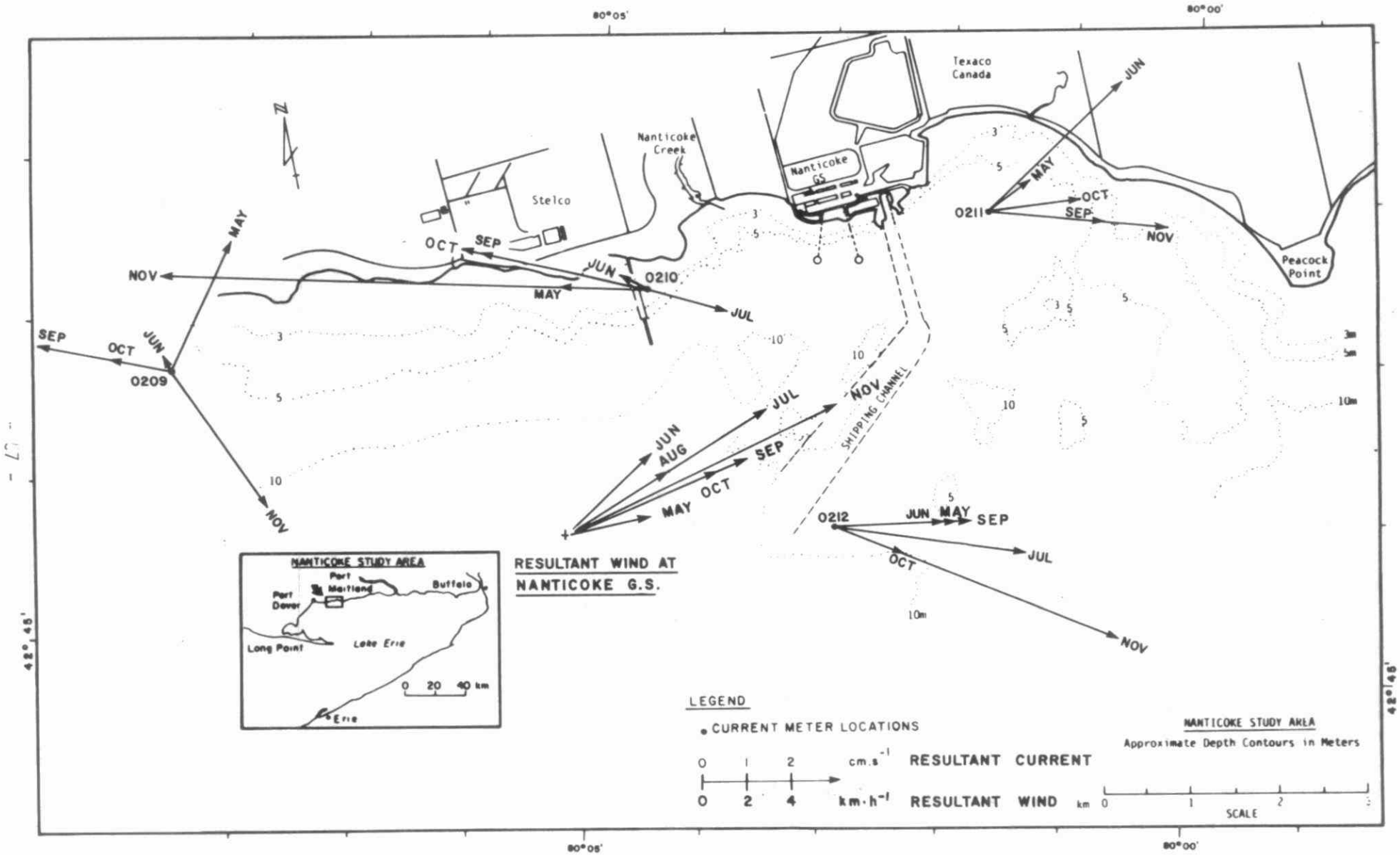


FIGURE 14 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1975.

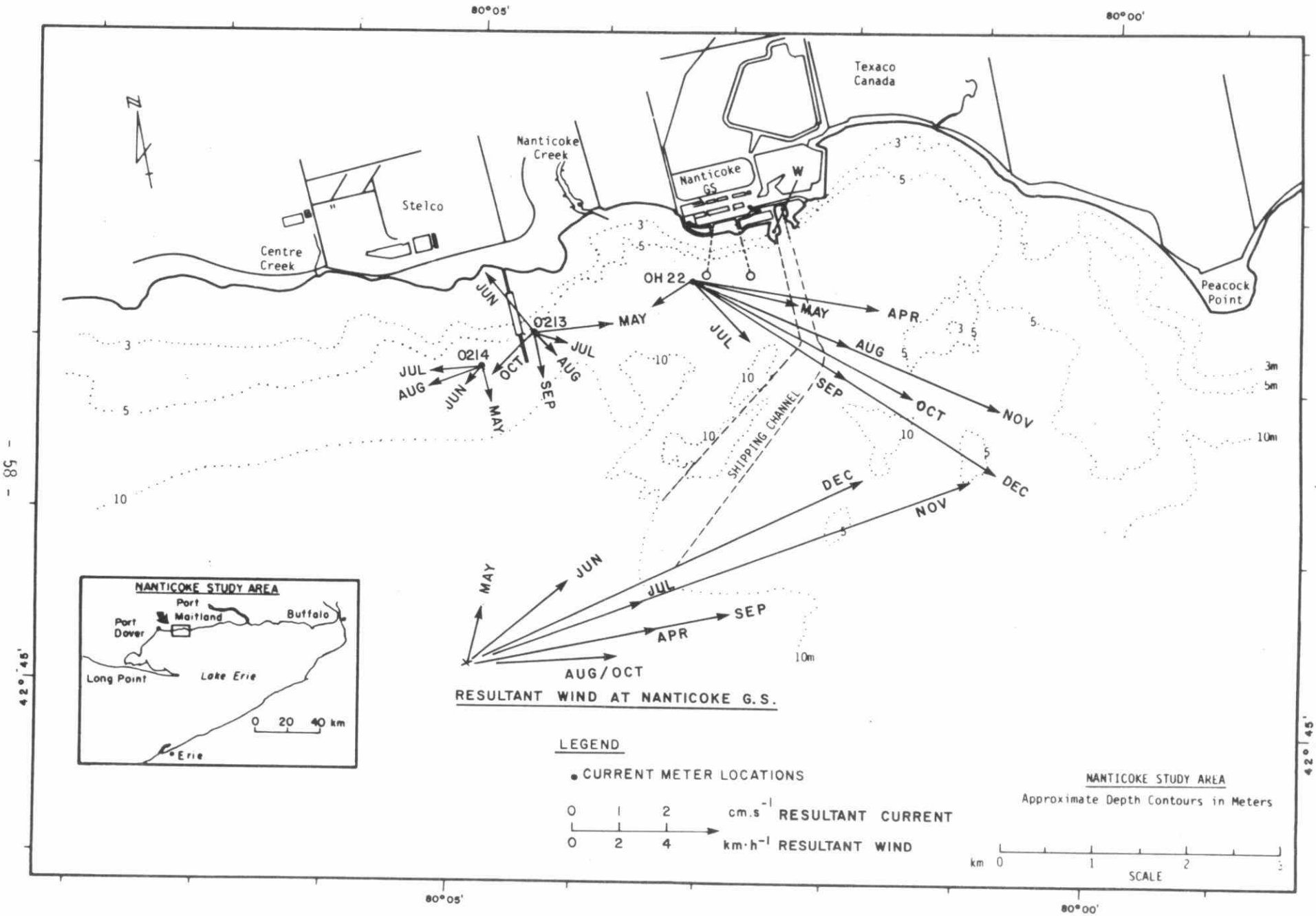


FIGURE 15 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1976.

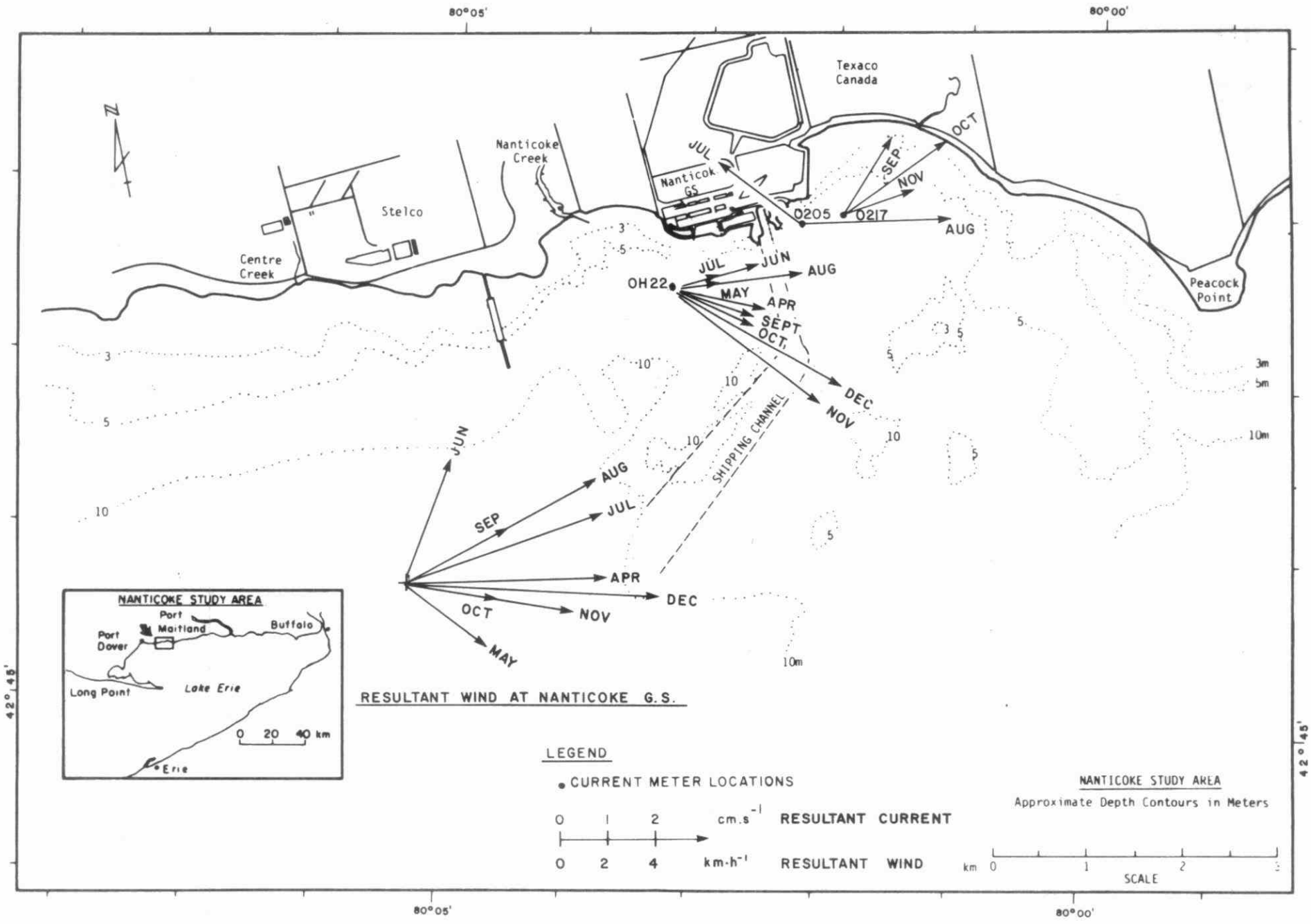


FIGURE 16 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1977.

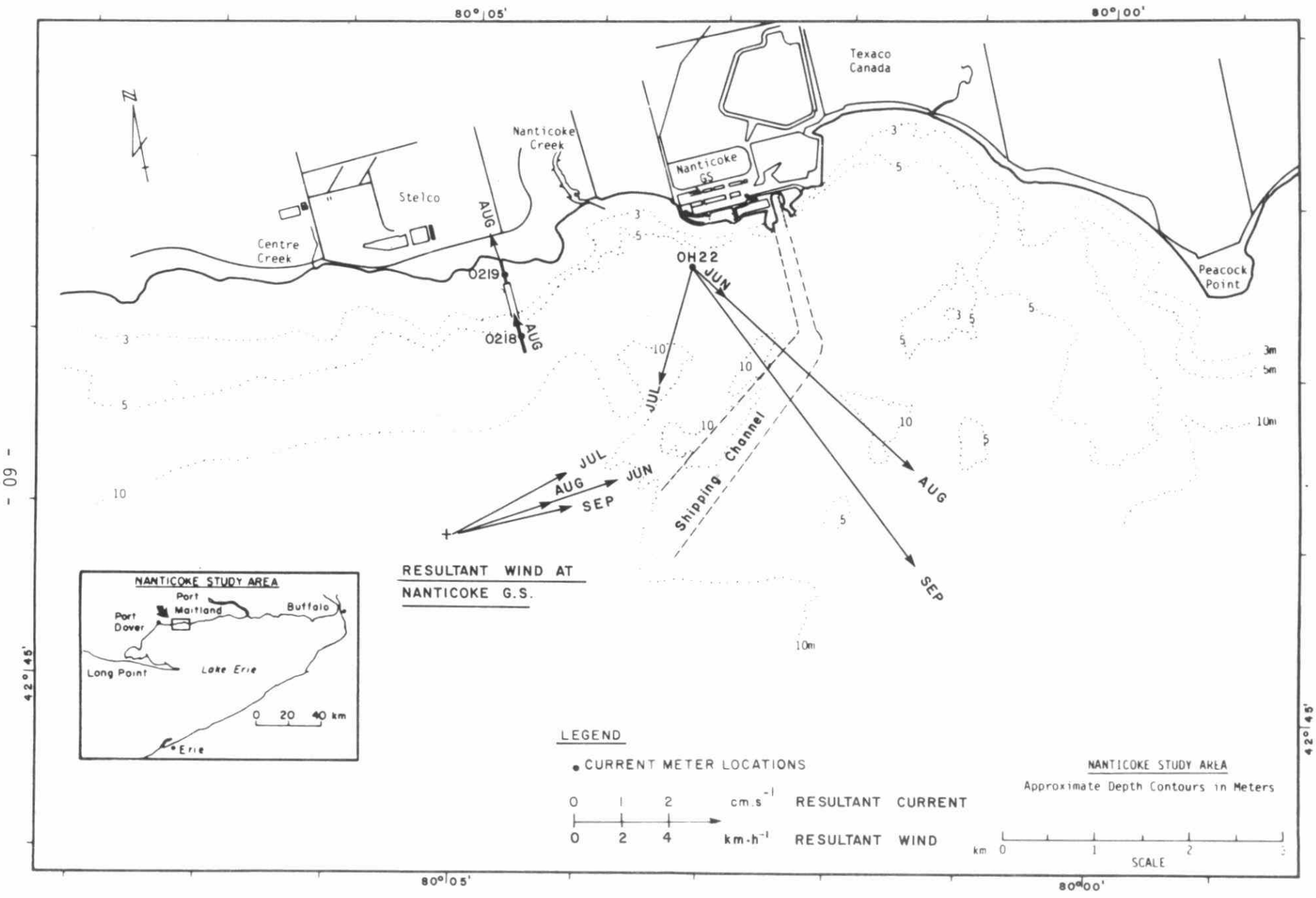


FIGURE 17 RESULTANT CURRENTS AND WINDS, NANTICOKE, LAKE ERIE, 1978.

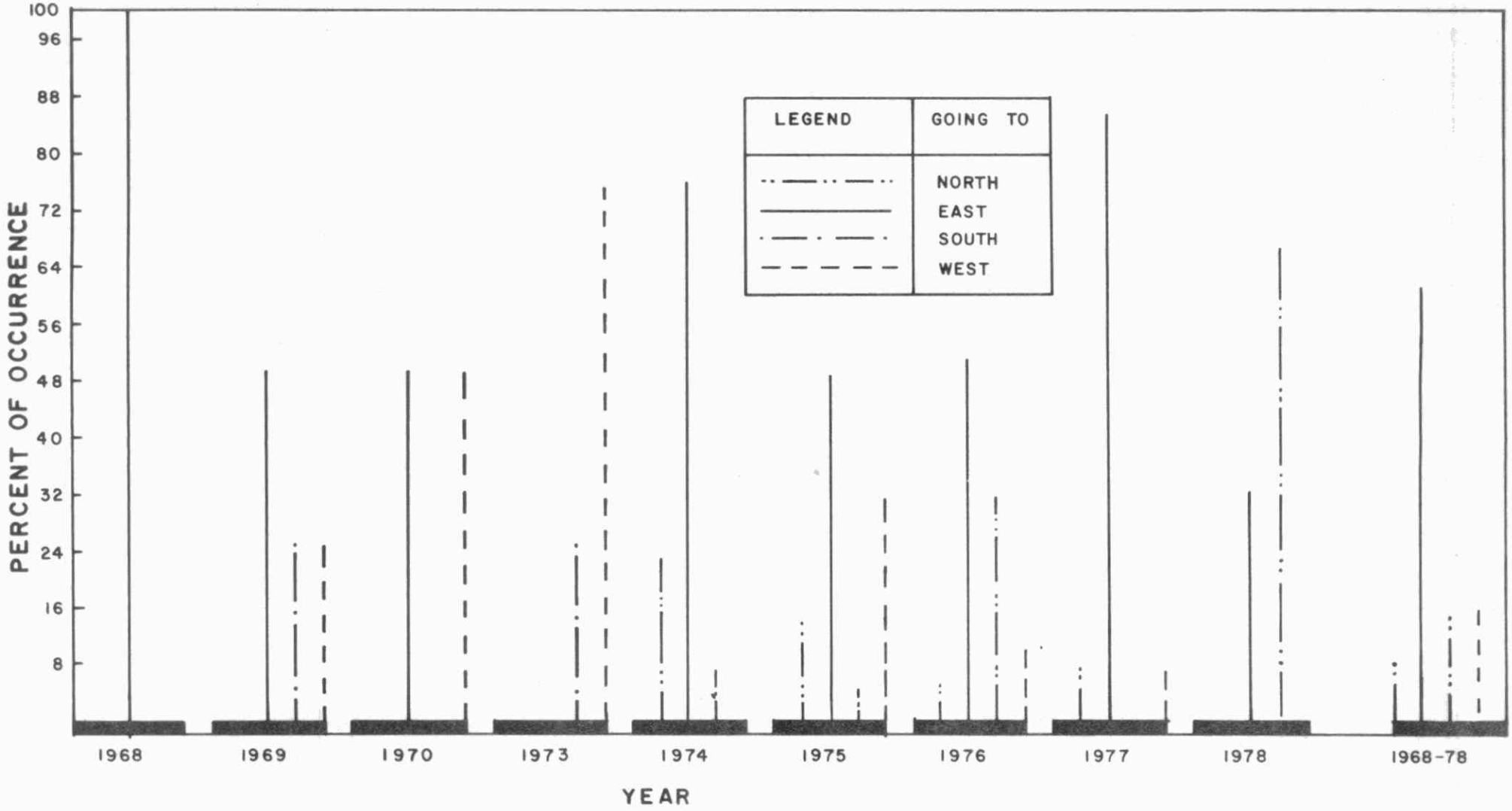


FIGURE 18 NET WATER MOVEMENT DIRECTIONS, NANTICOKE, LAKE ERIE, 1968-78.

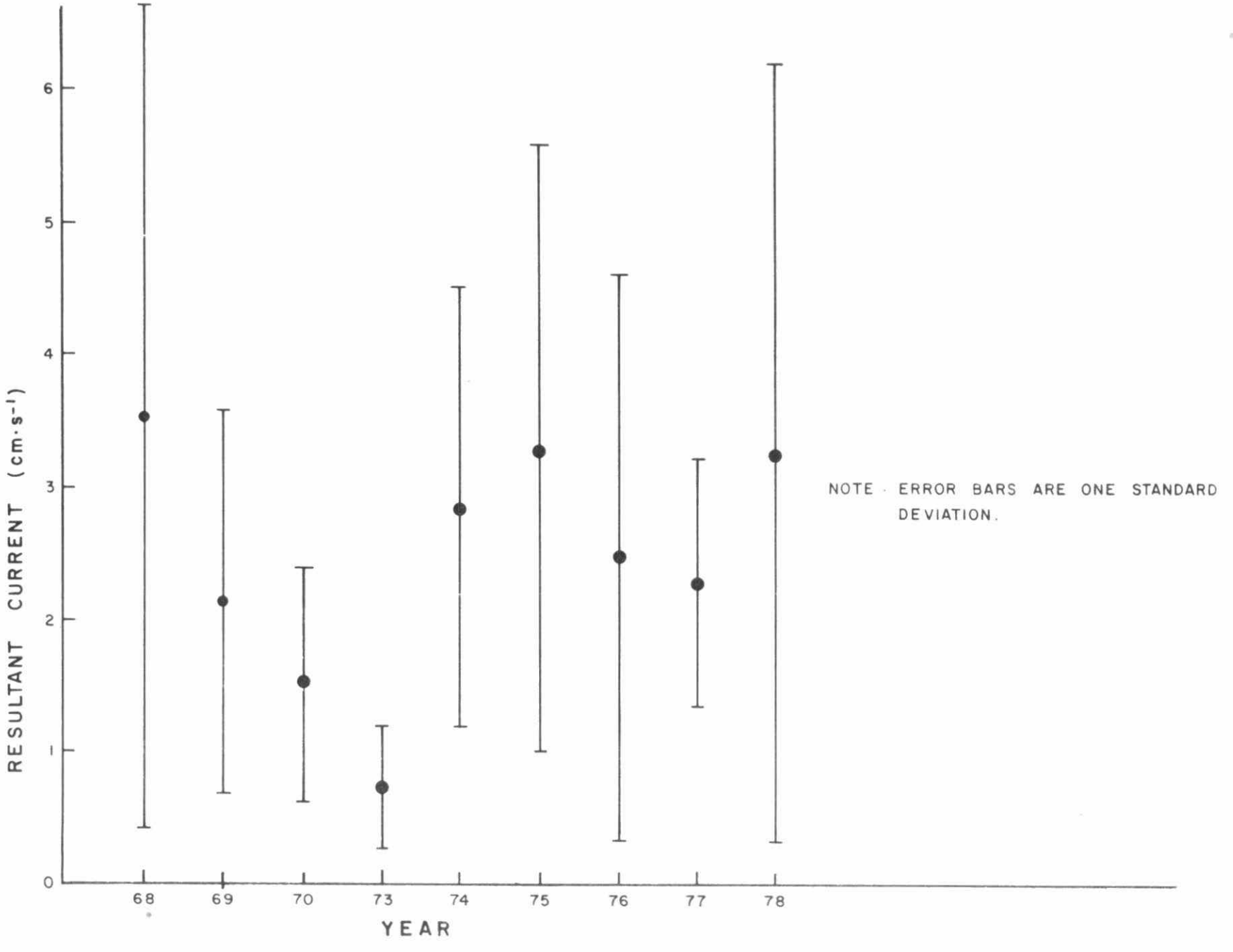


FIGURE 19 COMPARISON OF RESULTANT CURRENTS, NANTICOKE, LAKE ERIE, 1968-78.

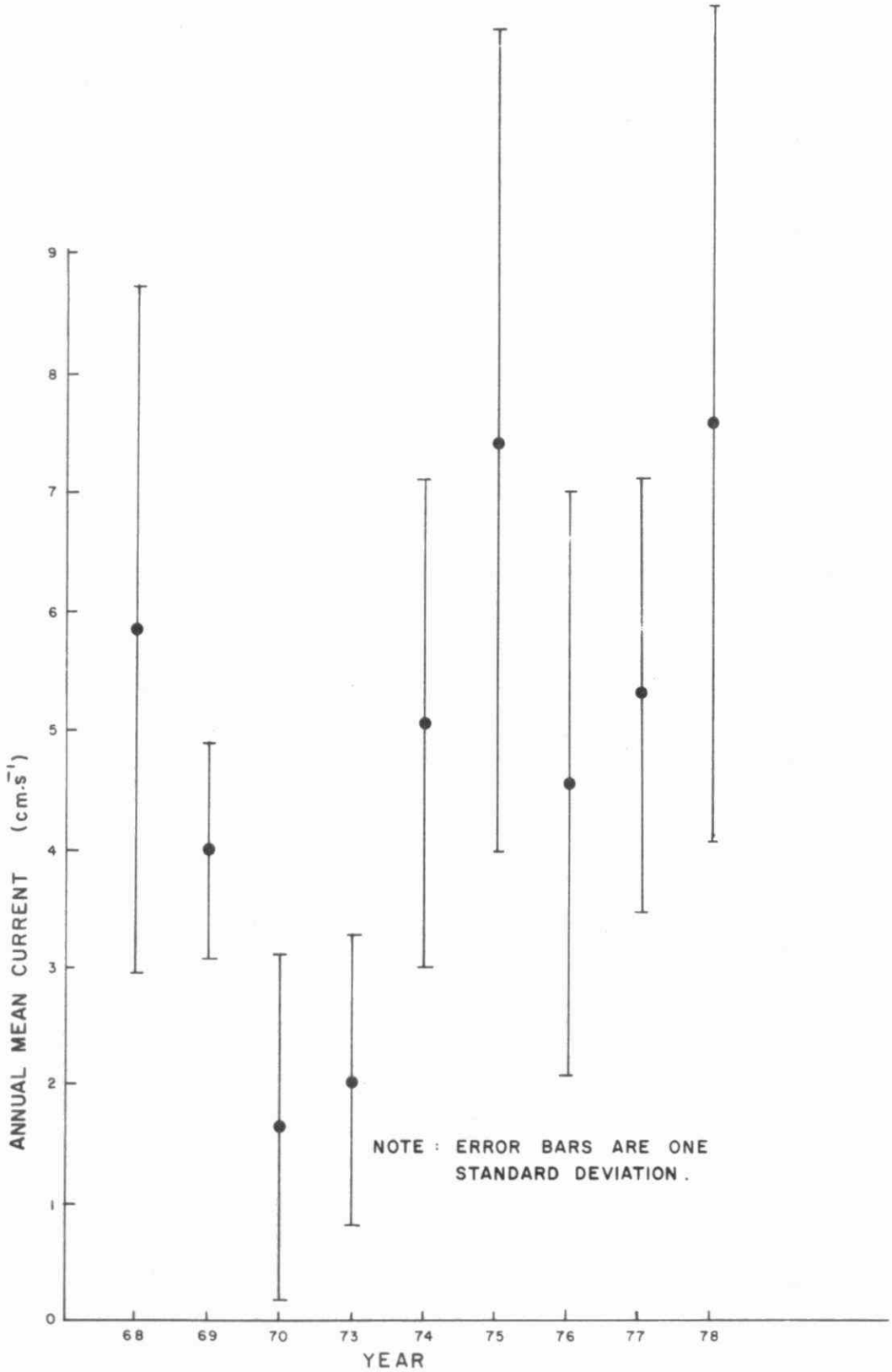
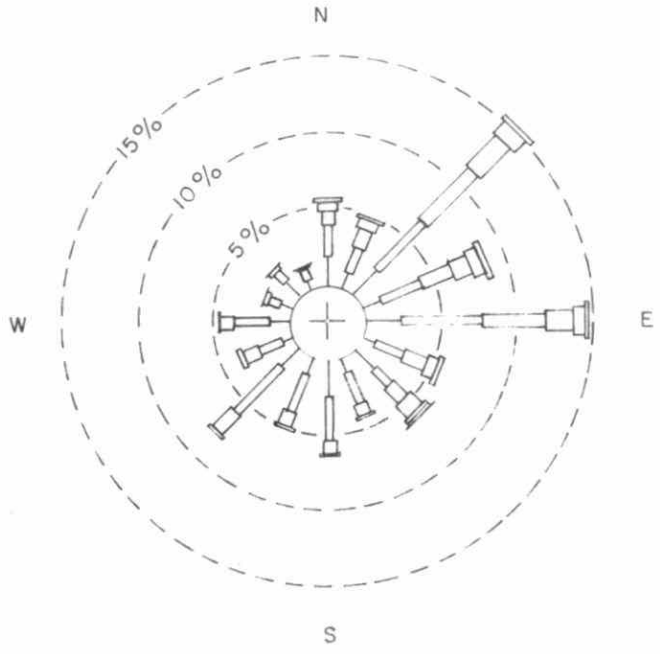


FIGURE 20 COMPARISON OF ANNUAL MEAN CURRENTS, NANTICOKE, LAKE ERIE 1968-78.



DIRECTION "GOING TO"

LEGEND

SPEED RANGE (km/h)

0·0 to 9·9	
10·0 to 19·9	
20·0 to 29·9	
30·0 to 39·9	
40·0 to 49·9	
50·0 to 59·9	

Fig. 21 LAKE ERIE – NANTICOKE G.S.
WIND ROSE HISTOGRAM — JULY 1967 TO JUNE 1979

APPENDIX

NANTICOKE WATER MOVEMENTS 1967-78

INSTRUMENTATION AND DATA ANALYSIS

INSTRUMENT OPERATION

Submersible, self-recording type instruments (Plessey MO21, Geodyne 920 and Hydro Products) were operated at various locations (see Figure 1 and Table 1) in Lake Erie, offshore of Nanticoke, from 1968 to 1978. The instruments were laboratory calibrated and set to record at fixed intervals of 10 to 30 min. The instruments were generally deployed in mid-depth at different locations, the exact instrument and water depths are presented in Table 1.

DATA ANALYSIS

All data were prewhitened (numerically smoothed) after Blackman and Turkey (1959; p. 29,39,74) using diurnal coefficients after Parofsky and Brier (1968; p. 150). The prewhitened data were then divided into monthly records to facilitate comparison of monthly data from year to year. Statistical analyses were performed on all current speed and direction data sets to produce the two-dimensional frequency of occurrence of the current speed and direction (see Table 1.001 to 1.105). The resultant currents varied from 0.2 to 11.3 $cm.s^{-1}$ and the arithmetic average currents ranged from 0.5 to 13.8 $cm.s^{-1}$. The maximum speed recorded was 75 $cm.s^{-1}$.

The hourly average current speeds along north-south and east-west directions were computed. These two series were then subjected to spectral analysis (Kohli, 1978) to compute the significant periodicities along the two major compass directions. Spectral analysis provided insight into the physical processes responsible for the currents.

Table 1.001 only is included in this report as an example.

Two-dimensional frequencies of occurrence of the wind speed and direction were computed for each month during the operation of current meters. The frequency tables are presented in Table 2.01 to 2.51. Table 2.01 only is included as an example.

The resultant wind speed varied from 2.1 to 23.5 km. h^{-1} and the arithmetic average wind speeds were from 3.4 to 26.5 $km.h^{-1}$. The maximum wind speed recorded from 1968 to 1978 was 84 $km.h^{-1}$. The monthly net wind direction was towards the east for 86% of the time.

Appendix with all the tables is being printed as a limited edition and is available to those who need it from Lake Systems, Water Resources Branch, Ontario Ministry of the Environment.

REFERENCES

1. Blackman, R.B., and J.W. Tukey, 1959. The Measurement of Power Spectra. Dover Publications, Inc. New York, 198p.

2. Kohli, B. 1978. Physical Aspects of Toronto Harbour. 1972-75. Ontario Ministry of the Environment, 135 St. Clair Ave. West, Toronto, Ontario, 50p.

3. Panofsky, H.A., and G.W. Brier, 1968. Some Applications of Statistics to Meteorology. The Pennsylvania State University, University Park, Pennsylvania.

TABLE 1,001

LOCATION CODE : 2101
AREA : NANTICOKE
LAKE : ERIE

PERIOD : OCT 68
LATITUDE : 42 47 24 N
LONGITUDE : 80 02 43 W

CURRENT FREQUENCY TABLE

SPEED(CM/S)	DIRECTION (ZERO DEGREE NORTH) N	NE	E	SE	S	SW	W	NW	ROW SUM
0,0 - 0,30	0,56	3,25	3,56	1,19	1,79	1,88	3,92	1,37	17,50
0,31 - 2,99	0,54	2,58	6,18	0,65	0,61	2,33	5,40	0,96	19,20
3,00 - 5,99	0,13	2,33	11,38	0,49	0,20	2,49	7,82	0,22	25,00
6,00 - 8,99	0,09	1,25	9,57	0,38	0,0	1,88	5,06	0,04	18,20
9,00 - 11,99	0,04	0,40	6,50	0,05	0,0	1,14	1,75	0,0	9,80
12,00 - 14,99	0,04	0,18	3,45	0,0	0,0	0,58	0,63	0,0	4,80
15,00 - 20,99	0,0	0,02	3,34	0,0	0,0	0,58	1,17	0,02	5,10
COLUMN SUMS	1,41	10,01	43,97	2,75	2,60	10,89	25,74	2,62	100,00

RESULTANT CURRENT IS 1,50 CM/S 92 DEGREES FROM NORTH
MEAN CURRENT IS 5,20 CM/S
MAXIMUM CURRENT IS 24,60 CM/S
MINIMUM CURRENT IS 0,0 CM/S

TOTAL NO. READINGS 4464
PERSISTENCE IS 0,29
READINGS TAKEN EVERY 10 MIN

METER OPERATIONS

METER OPERATED AT 2,7 M FROM BOTTOM IN 9,5 M OF WATER
STARTED AT 0,02 HRS. ON 1TH DAY OF 10TH MONTH 1968
ENDED AT 23,51 HRS. ON 31TH DAY OF 10TH MONTH 1968

TABLE 2.01

LOCATION: NANTICOKE G.S.

PERIOD: AUG 68

WIND FREQUENCY TABLE

	DIRECTION (ZERO DEGREE NORTH)									
SPEED(KM/H)	N	NE	E	SE	S	SW	W	NW	CALM	ROW SUM
0.0-9.9	1.98	1.80	4.68	2.52	4.50	3.24	2.88	1.98	0.72	24.28
10.0-19.9	5.76	7.19	8.63	10.79	5.58	3.78	3.24	1.08	0.0	46.04
20.0-29.9	0.90	10.25	4.68	3.96	0.0	1.80	0.54	0.18	0.0	22.30
30.0-39.9	0.54	5.40	1.26	0.0	0.0	0.0	0.0	0.18	0.0	7.37
40.0-49.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	9.17	24.64	19.24	17.27	10.07	8.81	6.65	3.42	0.72	100.00

RESULTANT WIND IS 7.32 KM/H 77 DEGREES FROM NORTH
MEAN WIND IS 16.30 KM/H
MAXIMUM WIND IS 38.62 KM/H

PERSISTENCE FACTOR IS 0.45